E. S. Moore

ANNUAL REPORT

OF THE

MINISTER OF MINES

FOR THE

YEAR ENDING 31ST DECEMBER

1921

BEING AN ACCOUNT OF

MINING OPERATIONS FOR GOLD, COAL, ETC.

IN THE

PROVINCE OF BRITISH COLUMBIA

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

DEPARTMENT OF GEOLOGICAL SCIENCES,
UNIVERSITY OF TORONTO

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1922.

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To His Honour WALTER CAMERON NICHOL,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1921 is herewith respectfully submitted.

WILLIAM SLOAN,

Minister of Mines.

Minister of Mines' Office,

February 24th, 1922.

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Similkameen River, below Keremeos.

To the Honourable William Sloan,
Minister of Mines.

SIR,—I have the honour to submit herewith my Annual Report on the Mining Industry of the Province for the year ending December 31st, 1921.

The statistical tables give the total mineral output of the Province to date, and show in considerable detail the actual mineral production of the past year, as based on smelter or mill returns; also, a summary of the production of each of the last four years, thus illustrating by comparison the progress made in productive mining during this period.

To facilitate comparison with information previously given, I have retained, as closely as was possible, the general form already established for such tables and for the Report.

I have the honour to be,
Sir,
Your obedient servant,

WILLIAM FLEET ROBERTSON,
Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,
February 24th, 1922.

MINERAL PRODUCTION OF BRITISH COLUMBIA.

METHOD OF COMPUTING PRODUCTION.

In assembling the output of the lode mines in the following tables, the established custom of this Bureau has been adhered to, viz.: The output of a mine for the year is considered that amount of ore for which the smelter or mill returns have been received during the year. This system does not give the exact amount mined during the year, but rather the amount credited to the mine on the company's books during such year.

For ore shipped in December the smelter returns are not likely to be received until February in the new year, or later, and have, consequently, to be carried over to the credit of such new year. This plan, however, will be found very approximate for each year, and ultimately correct, as ore not credited in one year is credited in the next.

In the lode mines tables, the amount of the shipments has been obtained from certified returns received from the various mines, as provided for in the "Inspection of Metalliferous Mines Act, 1897." In calculating the value of the products, the average prices for the year in the New York Metal Market have been used as a basis. For silver 95 per cent., for lead 90 per cent., and for zinc 85 per cent. of such market prices have been taken. Treatment and other charges have not been deducted, except that in copper the amount of metal actually recovered has been taken, thus covering loss in slags.

TABLE I.—Total Production for all Years up to and including 1921.

Gold, placer	$ 76,177,403
Gold, lode	105,557,977
Silver	55,259,485
Copper	166,393,488
Lead	48,330,575
Zinc	21,848,531
Coal and coke	225,409,505
Building-stone, bricks, etc.	34,072,016
Miscellaneous minerals, etc	1,210,639
Total	$734,259,619

TABLE II.—Production for each Year from 1852 to 1921 (inclusive).

1852 to 1892 (inclusive)	$ 81,090,069
1893	3,588,413
1894	4,225,717
1895	5,643,042
1896	7,507,956
1897	10,455,268
1898	10,906,861
1899	12,393,131
1900	16,344,751
1901	20,086,780
1902	17,486,550
1903	17,495,954
1904	18,977,359
1905	22,461,325
1906	24,980,546
1907	25,882,560
1908	23,851,277
1909	24,443,025
1910	26,377,066
1911	23,499,072
1912	32,440,800
1913	30,296,398
1914	26,388,825
1915	29,447,508
1916	42,290,462
1917	37,010,392
1918	41,782,474
1919	33,296,313
1920	35,543,084
1921	28,066,641
Total	$734,259,619

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1919, 1920, and 1921. It is difficult to get absolutely complete statistics regarding building-stone, lime, bricks, tiles, and other miscellaneous products, but the detail figures shown in Table V. are as nearly accurate as can be obtained.

TABLE III.

QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1919, 1920, AND 1921.

	Customary Measure.	1919.		1920.		1921.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold placer	Ounces.	14,325	$ 286,500	11,080	$ 221,600	11,660	$ 233,200
" lode	"	152,426	3,150,645	120,048	2,481,392	135,663	2,804,154
Silver	"	3,403,119	3,592,673	3,377,849	3,235,980	2,673,389	1,591,201
Copper	Pounds	42,459,339	7,939,896	44,887,676	7,832,899	39,036,993	4,879,624
Lead	"	29,475,968	1,526,855	39,331,218	2,816,115	41,402,288	1,693,354
Zinc	"	56,737,651	3,540,429	47,208,268	3,077,979	49,419,372	1,952,065
Coal	Tons, 2,240 lb.	2,267,541	11,337,705	2,595,125	12,975,625	2,483,995	12,419,975
Coke	" "	91,138	637,966	67,792	474,544	59,434	416,038
Miscellaneous products			1,283,644		2,426,950		2,077,030
			$33,296,313		$35,543,084		$28,066,641

TABLE IV.

OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

NAMES.	DIVISIONS.			DISTRICTS.		
	1919.	1920.	1921.	1919.	1920.	1921.
CARIBOO DISTRICT				$ 196,801	$ 222,335	$ 80,807
Cariboo and Quesnel Mining Division	$ 73,500	$ 66,000	$ 67,400			
Omineca Mining Division	123,301	156,335	13,407			
CASSIAR DISTRICT				6,402,082	7,293,008	7,323,662
EAST KOOTENAY DISTRICT				6,612,954	9,428,989	7,652,977
WEST KOOTENAY DISTRICT				4,669,090	3,049,731	1,638,618
Ainsworth Division	405,478	558,339	121,760			
Slocan and Slocan City "	2,900,087	1,390,563	181,011			
Nelson and Arrow Lake "	76,719	100,565	76,862			
Trail Creek "	1,275,538	982,020	1,250,233			
Revelstoke, Trout Lake, Lardeau	11,268	18,244	8,752			
BOUNDARY-YALE DISTRICT				2,527,514	2,011,803	1,272,511
Osoyoos, Grand Forks, and Greenwood Divisions	1,637,827	1,109,527	334,146			
Similkameen, Nicola, Vernon	759,637	842,287	936,865			
Yale, Ashcroft, Kamloops	130,050	59,989				
LILLOOET DISTRICT				62,684	15,980	20,730
COAST DISTRICT (Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver)				12,825,188	13,521,238	10,077,336
				$33,296,313	$35,543,084	$28,066,641

TABLE V.

Miscellaneous Products and Totals of Production, 1921.

District and Division.	Cement.	Lime and Limestone.	Building-stone.	Riprap.	Crushed Rock, Flux.	Sand and Gravel.	Pottery and Clay.	Fire, Face, and Red Brick.	Total Building Materials.	Miscellaneous Minerals.	Total Miscellaneous Products.	Total Output of Collieries.	Total Metalliferous Minerals.	Totals for Divisions.	Totals for Districts.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Cariboo															80,807
Cariboo and Quesnel													67,400	67,400	
Omineca												4,000	9,407	13,407	
Cassiar															7,323,602
Atlin, Stikine, Liard													148,546	148,546	
Skeena, Nass River, Portland Canal, Queen Charlotte		15,734	50,000		63,764				129,498		129,498		7,045,618	7,175,116	
East Kootenay															7,652,977
Fort Steele										5,605	5,605	3,786,593	3,834,016	7,626,214	
Windermere, Golden													26,763	26,763	
West Kootenay															1,638,618
Ainsworth													121,760	121,760	
Slocan and Slocan City													181,011	181,011	
Nelson, Arrow Lake													76,862	76,862	
Trail Creek													1,250,233	1,250,233	
Other Divisions						4,723			4,723		4,723		4,029	8,752	
Boundary-Yale															1,272,511
Grand Forks Greenwood Osoyoos Similkameen Nicola Vernon Yale		10,131	600					19,500	10,131 20,100	156,901	167,032 20,100	915,765	167,114 1,000	334,146 936,865	
Ashcroft Kamloops								500	500		500		1,000	1,500	
Lillooet-Clinton										5,000	5,000		15,730	20,730	20,730
Lillooet and Clinton															10,077,336
Coast, Southern															
Vancouver Island (Nanaimo, Quatsino, Clayoquot, Alberni, Victoria)	620,406	273,326				35,424	759	70,690	1,000,605	5,725	1,006,330	8,129,655	8,606	9,144,591	
Mainland (Vancouver, New Westminster)			183,050	924	72,999	137,922	158,689	184,658	738,242		738,242		194,503	932,745	
Totals	620,406	299,191	233,650	924	136,763	178,069	159,448	275,348	1,903,799	173,231	2,077,030	12,836,013	13,153,598	28,066,641	28,066,641

TABLE VI.—PLACER GOLD.

Table VI. contains the yearly production of placer gold to date, as determined by the returns sent in by the banks and express companies, of gold transmitted by them to the mints, and from returns sent in by the Gold Commissioners and Mining Recorders. To these yearly amounts one-third was added up to the year 1878; from then to 1895 and from 1898 to 1909, one-fifth; and since then one-tenth, which proportions are considered to represent, approximately, the amount of gold sold of which there is no record. This placer gold contains from 10 to 25 per cent. silver, but the silver value has not been separated from the totals, as it would be insignificant.

YIELD OF PLACER GOLD TO DATE.

1858	$ 705,000	1874	$1,844,618	1890	$ 490,435	1906	$ 948,400
1859	1,615,070	1875	2,474,004	1891	429,811	1907	828,000
1860	2,228,543	1876	1,786,648	1892	399,526	1908	647,000
1861	2,666,118	1877	1,608,182	1893	356,131	1909	477,000
1862	2,656,903	1878	1,275,204	1894	405,516	1910	540,000
1863	3,913,563	1879	1,290,058	1895	481,683	1911	426,000
1864	3,735,850	1880	1,013,827	1896	544,026	1912	555,500
1865	3,491,205	1881	1,046,737	1897	513,520	1913	510,000
1866	2,662,106	1882	954,085	1898	643,346	1914	565,000
1867	2,480,868	1883	794,252	1899	1,344,900	1915	770,000
1868	3,372,972	1884	736,165	1900	1,278,724	1916	580,500
1869	1,774,978	1885	713,738	1901	970,100	1917	496,000
1870	1,336,956	1886	903,651	1902	1,073,140	1918	320,000
1871	1,799,440	1887	693,709	1903	1,060,420	1919	286,500
1872	1,610,972	1888	616,731	1904	1,115,300	1920	221,600
1873	1,305,749	1889	588,923	1905	969,300	1921	233,200
						Total	$76,177,403

TABLE VII.—PRODUCTION OF LODE MINES.

YEAR.	GOLD.		SILVER.		COPPER.		LEAD.		ZINC.		TOTAL VALUE.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
		$		$		$		$		$	$
1887			17,690	17,331			204,800	9,216			26,547
1888			79,780	75,000			674,500	29,813			104,813
1889			53,192	47,873			165,100	6,498			54,371
1890			70,427	73,948			*Nil.*	*Nil.*			73,948
1891			4,500	4,000			*Nil.*	*Nil.*			4,000
1892			77,160	66,935			808,420	33,064			99,999
1893	1,170	23,404	227,000	195,000			2,135,023	78,996			297,400
1894	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,875			781,342
1895	39,264	785,271	1,496,522	977,229	952,840	47,642	16,475,464	532,255			2,342,397
1896	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384			4,257,179
1897	106,141	2,122,820	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517			7,052,431
1898	110,061	2,201,217	4,292,401	2,375,841	7,271,678	874,781	31,693,559	1,077,581			6,529,420
1899	138,315	2,857,573	2,939,413	1,663,708	7,722,591	1,351,453	21,862,436	878,870			6,751,604
1900	167,153	3,453,381	3,958,175	2,309,200	9,997,080	1,615,289	63,358,621	2,691,887			10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	27,603,746	4,446,963	51,582,906	2,002,733			13,683,044
1902	236,491	4,888,269	3,917,917	1,941,328	29,636,057	3,446,673	22,536,381	824,832			11,101,102
1903	232,831	4,812,616	2,996,204	1,521,472	34,359,921	4,547,535	18,089,283	689,744			11,571,367
1904	222,042	4,589,608	3,222,481	1,719,516	35,710,128	4,578,037	36,646,244	1,421,874			12,309,035
1905	238,660	4,933,102	3,439,417	1,971,318	37,692,251	5,876,222	56,580,703	2,399,022			15,180,164
1906	224,027	4,630,639	2,990,262	1,897,320	42,990,488	8,288,565	52,408,217	2,667,578			17,484,102
1907	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,738,703	2,291,458			16,216,847
1908	255,582	5,282,880	2,631,389	1,321,483	47,274,614	6,240,249	43,195,733	1,632,799			14,477,411
1909	238,224	4,924,090	2,532,742	1,239,270	45,597,245	5,918,522	44,396,346	1,709,259	8,500,000	400,000	14,191,141
1910	267,701	5,533,380	2,450,241	1,245,016	38,243,934	4,871,512	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,045	51,456,537	8,408,513	44,871,454	1,805,627	5,358,280	316,139	17,662,766
1913	272,254	5,627,490	3,465,856	1,968,606	46,460,305	7,094,489	55,364,677	2,175,232	6,758,768	324,421	17,190,838
1914	247,170	5,109,004	3,602,180	1,876,736	45,009,699	6,121,319	50,625,048	1,771,877	7,866,467	346,125	15,225,061
1915	250,021	5,167,934	3,366,506	1,588,991	56,918,405	9,835,500	46,503,590	1,939,200	12,982,440	1,460,524	19,992,149
1916	221,932	4,587,334	3,301,923	2,059,739	65,379,364	17,784,494	48,727,516	3,007,462	37,168,980	4,043,985	31,483,014
1917	114,523	2,367,190	2,929,216	2,265,749	59,007,565	16,038,256	37,307,465	2,951,020	41,848,513	3,166,259	26,788,474
1918	164,674	3,403,812	3,498,172	3,215,870	61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,590,278
1919	152,426	3,150,645	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429	19,750,498
1920	120,048	2,481,392	3,377,849	3,235,980	44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979	19,444,365
1921	135,663	2,804,154	2,673,389	1,591,201	39,036,993	4,879,624	41,402,288	1,693,354	49,419,372	1,952,065	12,920,398
To'l	5,117,551	105,557,977	89,291,069	55,259,485	964,380,002	166,393,488	1,078,296,102	48,330,575	322,440,391	21,848,531	397,390,056

TABLE VIII.—COAL AND COKE PRODUCTION PER YEAR TO DATE

COAL.

Year.	Tons (2,240 lb.).	Value.
1836-1881	1,873,907	$ 6,003,245
1882	282,139	846,417
1883	213,299	639,897
1884	394,070	1,182,210
1885	265,596	796,788
1886	326,636	979,908
1887	413,360	1,240,080
1888	489,301	1,467,903
1889	579,830	1,739,490
1890	678,140	2,034,420
1891	1,029,097	3,087,291
1892	826,335	2,479,005
1893	978,294	2,934,882
1894	1,012,953	3,038,859
1895	939,654	2,818,962
1896	896,222	2,688,666
1897	882,854	2,648,562
1898	1,135,865	3,407,595
1899	1,306,324	3,918,972
1900	1,439,595	4,318,785
1901	1,460,331	4,380,993
1902	1,397,394	4,192,182
1903	1,168,194	3,504,582
1904	1,253,628	3,760,884
1905	1,384,312	4,152,936
1906	1,517,303	4,551,909
1907	1,800,067	6,300,235
1908	1,677,849	5,872,472
1909	2,006,476	7,022,666
1910	2,800,046	9,800,161
1911	2,193,062	7,675,717
1912	2,628,804	9,200,814
1913	2,137,483	7,481,190
1914	1,810,967	6,338,385
1915	1,611,129	5,638,952
1916	2,084,093	7,294,325
1917	2,149,975	7,524,913
1918	2,302,245	11,511,225
1919	2,267,541	11,337,705
1920	2,595,125	12,975,625
1921	2,483,995	12,419,975
Total	56,693,490	$201,209,783

COKE.

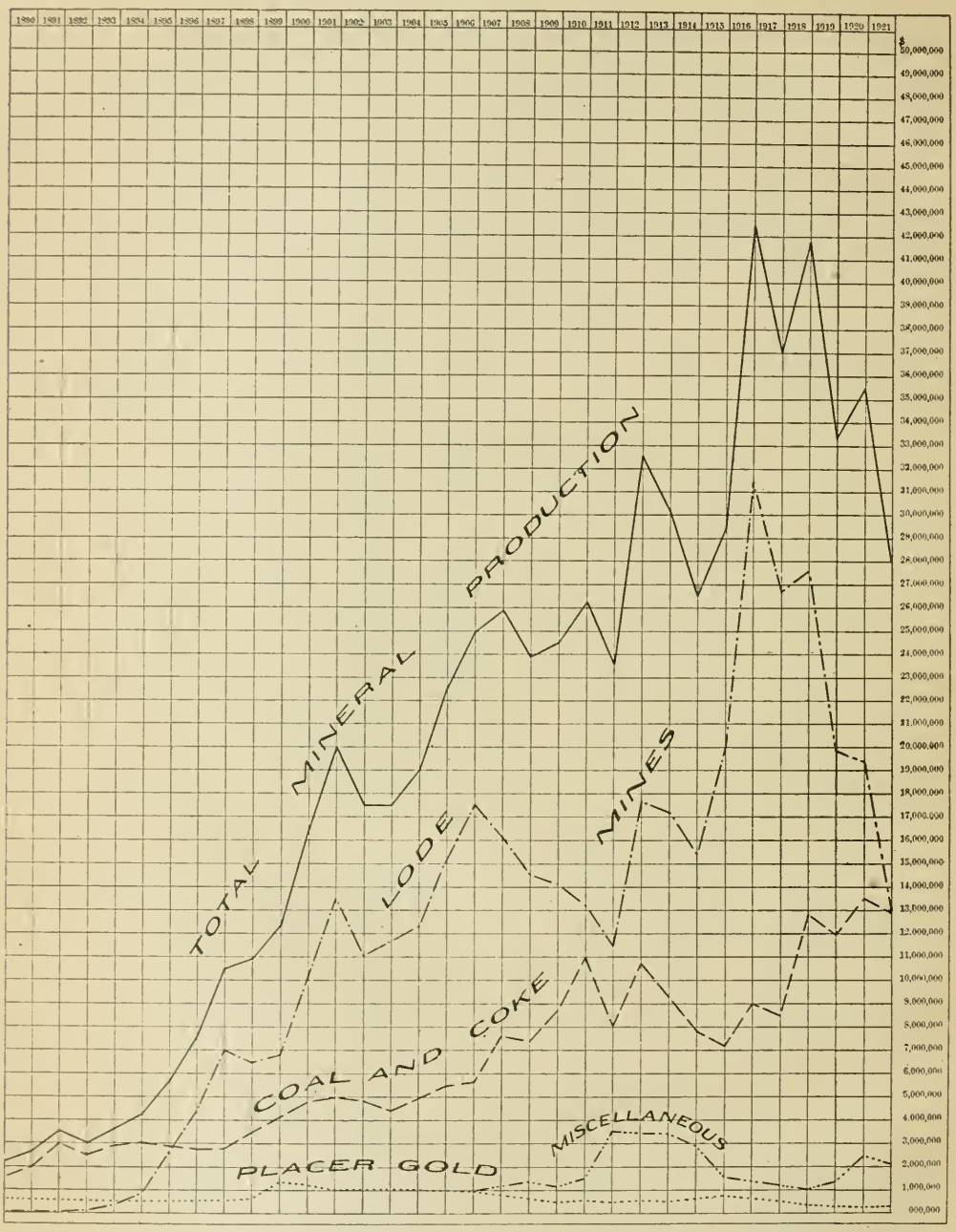
Year.	Tons (2,240 lb.).	
1895-97	19,396	$ 96,980
1898 (estimated)	35,000	175,000
1899	34,251	171,255
1900	85,149	425,745
1901	127,081	635,405
1902	128,015	640,075
1903	165,543	827,715
1904	238,428	1,192,140
1905	271,785	1,358,925
1906	199,227	996,135
1907	222,913	1,337,478
1908	247,399	1,484,394
1909	258,703	1,552,218
1910	218,029	1,308,174
1911	66,005	396,030
1912	264.333	1,585,998
1913	286,045	1,716,270
1914	234,577	1,407,462
1915	245,871	1,475,226
1916	267,725	1,606,350
1917	159,905	959,430
1918	188,967	1,322,769
1919	91,138	637,966
1920	67,792	474,544
1921	59,434	416,038
Total	4,182,701	$24,199,722

TABLE IX.—PRODUCTION IN DETAIL OF THE

DISTRICT.	YEAR	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
Cariboo								
Cariboo and Quesnel Divisions	1918		4,000	80,000				
	1919		3,500	70,000				
	1920		3,300	66,000				
	1921		3,370	67,400				
Omineca Division	1918	6,956	400	8,000	985	20,360	84,125	77,336
	1919	4,051	400	8,000	147	3,038	72,573	76,615
	1920	4,000	150	3,000	218	4,506	103,020	98,693
	1921	71	150	3,000	13	269	3,745	2,229
Cassiar								
Atlin, Stikine, and Liard Divisions	1918	73	11,025	220,500	446	9,219	1,115	1,025
	1919		8,850	177,000				
	1920		6,930	138,600				
	1921	55	7,210	144,200	3	62	1,803	1,076
Skeena, Nass, Portland Canal, and Queen Charlotte Divisions	1918	956,231			48,016	992,491	416,616	382,995
	1919	760,057	850	17,000	60,076	1,241,771	920,413	971,680
	1920	944,208	150	3,000	54,531	1,127,156	1,317,832	1,262,483
	1921	1,061,283	100	2,000	85,182	1,760,713	1,563,999	930,892
East Kootenay								
Fort Steele Division	1918	137,950	50	1,000			261,497	240,394
	1919	145,039	50	1,000			205,500	216,946
	1920	267,381	175	3,500			362,143	346,933
	1921	238,516	180	3,600	1	20	546,631	325,355
Windermere-Golden	1918	3,620					91,784	84,377
	1919	2,697			2	41	68,634	72,457
	1920	1,977					53,510	51,263
	1921	440					18,508	11,016
West Kootenay								
Ainsworth Division	1918	44,937			18	372	228,699	210,243
	1919	30,157			26	537	167,453	176,780
	1920	18,213			32	661	266,963	255,751
	1921	5,523			11	227	115,772	68,907
Slocan and Slocan City	1918	142,700			67	1,385	1,873,236	1,722,066
	1919	139,824			95	1,964	1,556,714	1,643,423
	1920	59,768			73	1,509	738,515	707,497
	1921	5,692			19	393	188,142	111,932
Nelson and Arrow Lake Divisions	1918	15,348	50	1,000	7,155	147,894	136,738	125,703
	1919	5,694	25	500	297	6,139	44,280	46,747
	1920	6,189	25	500	1,924	39,769	7,065	6,768
	1921	11,048	50	1,000	3,587	74,143	2,130	1,268
Trail Creek Division	1918	112,349			43,745	904,209	47,203	43,394
	1919	88,266			50,229	1,038,233	27,788	29,336
	1920	67,714			36,425	752,905	36,411	34,882
	1921	89,107			44,980	929,737	60,184	35,822
Revelstoke, Trout Lake, and Lardeau	1918	255	50	1,000	35	723	11,761	10,812
	1919	47	50	1,000	8	165	2,994	3,161
	1920	91	50	1,000	7	145	7,979	7,644
	1921	31	50	1,000	8	165	3,871	2,304
Boundary-Yale								
Grand Forks, Greenwood, and Osoyoos Divisions.	1918	692,504	50	1,000	55,353	1,144,147	227,113	208,785
	1919	252,106	50	1,000	32,874	679,506	222,680	235,083
	1920	84,125	25	500	20,366	420,965	385,681	369,482
	1921	41,658	25	500	735	15,192	160,051	95,262
Similkameen, Nicola, and Vernon Divisions	1918	73	250	5,000	1	21	131	120
	1919	154	50	1,000	25	517	6,823	7,203
	1920	18,926	25	500	83	1,716	4,876	4,671
	1921		50	1,000				
Yale, Ashcroft, and Kamloops Divisions	1918	30,826	50	1,000	815	16,846	1,317	1,211
	1919	29,871	100	2,000	627	12,960	2,096	2,213
	1920	1,025	50	1,000	238	4,919	437	419
	1921		50	1,000				
Lillooet								
Lillooet and Clinton Divisions	1918	3,858	50	1,000	2,473	51,117	412	379
	1919	4,720	375	7,500	2,506	51,799	365	385
	1920	200	175	3,500	120	2,480		
	1921	500	400	8,000	374	7,730		
Southern Coast								
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria Divisions)	1918	13,269	25	500	2,515	51,985	23,040	21,181
	1919	7,657	25	500	1,164	24,060	9,936	10,490
	1920	6,183	25	500	19	393	2,745	2,630
	1921	1,331	25	500	104	2,150	605	360
Mainland (Vancouver and New Westminster Divisions)	1918	731,900			3,050	63,043	93,385	85,849
	1919	642,635			4,350	89,915	94,870	100,154
	1920	698,117			6,012	124,268	90,672	86,864
	1921	47,385			646	13,353	7,943	4,728
TOTALS	1918	2,892,849	16,000	320,000	164,674	3,403,812	3,498,172	3,215,870
	1919	2,112,975	14,325	286,500	152,426	3,150,645	3,403,119	3,592,673
	1920	2,178,187	11,080	221,600	120,048	2,481,392	3,377,849	3,235,980
	1921	1,562,645	11,660	233,200	135,663	2,804,154	2,673,389	1,591,201

METALLIFEROUS MINES, ETC., FOR 1918, 1919, 1920, AND 1921.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.				TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1918.	1919.	1920.	1921.	1921.
	$		$		$	$	$	$	$	$
										76,807
						80,000				
							70,000			
								66,000		
									67,400	
643,843	158,578	123,568	8,242	313,112	21,730	294,246				
16,205	3,030	180,455	9,347	224,539	14,011		114,041			
		189,488	13,567	453,512	29,569			149,335		
26,000	3,250	4,930	202	11,561	457				9,407	
										7,194,164
11,160	2,749					233,493				
							177,000			
								138,600		
25,664	3,208								148,546	
30,190,606	7,435,946					8,811,432				
20,411,421	3,816,936						6,047,387			
26,153,406	4,563,769							6,956,408		
34,816,103	4,352,013								7,045,618	
										3,860,779
1,768	435	18,695,565	1,246,994	26,704,806	1,853,313	3,342,136				
		10,729,483	555,787	46,460,703	2,899,148		3,672,881			
		26,926,319	1,927,924	42,881,092	2,795,847			5,074,204		
		38,066,820	1,556,933	49,319,198	1,948,108				3,834,016	
		2,659,210	177,369			261,746				
		1,659,279	85,951				158,449			
1,953	341	1,095,486	78,437					130,041		
		385,000	15,747						26,763	
										1,633,895
		6,106,262	407,288	640,991	44,485	662,388				
		4,336,602	224,636	36,785	2,295		404,248			
		4,072,807	291,613	158,193	10,314			558,339		
		1,264,845	51,732	22,629	834				121,760	
242	60	14,575,379	972,178	14,107,682	979,073	3,674,762				
		12,156,845	629,725	10,015,624	624,975		2,900,087			
		6,135,581	439,308	3,715,471	242,249			1,390,563		
		1,614,425	66,030	65,984	2,606				181,011	
28,933	7,126	1,611,166	107,465			389,188				
21,964	4,107	292,010	15,126				72,619			
755	132	719,219	51,496					98,665		
3,183	398	1,301	53						76,862	
1,654,356	407,468					1,355,071				
1,112,133	207,969						1,275,538			
1,113,085	194,233							982,020		
2,277,392	284,674								1,250,233	
		80,773	5,387	6,325	439	18,361				
		44,035	2,281				6,607			
		83,165	5,955					14,744		
		13,699	560						4,029	
										169,114
9,940,125	2,448,253	47,738	3,184			3,805,369				
3,273,655	612,173	43,200	2,238				1,530,000			
582,360	101,622	106,433	7,620					900,189		
432,505	54,063	51,268	2,097						167,114	
11,928	2,938					8,079				
5,180	969	4,594	238				9,927			
463,347	80,854	2,720	195					87,936		
									1,000	
525,780	129,500					148,557				
556,681	104,099	29,465	1,526				122,798			
260,808	45,511							51,849		
									1,000	
										15,730
						52,496				
							59,684			
								5,980		
									15,730	
										203,109
926,886	228,292					301,958				
432,252	80,831						115,881			
110,696	19,316							22,839		
44,770	5,596								8,606	
17,548,127	4,322,104					4,470,996				
16,629,848	3,109,782						3,299,851			
16,201,266	2,827,121							3,038,253		
1,411,376	176,422								194,503	
61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,910,278				
42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429		20,036,998			
44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979			19,665,965		
39,036,983	879,624	41,402,288	1,693,354	49,419,372	1,952,065				13,153,598	13,153,598


1880 1881 1882 1883 1884 1885 1886 1887 1888 1889 1890 1891 1892 1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921
$
50,000,000
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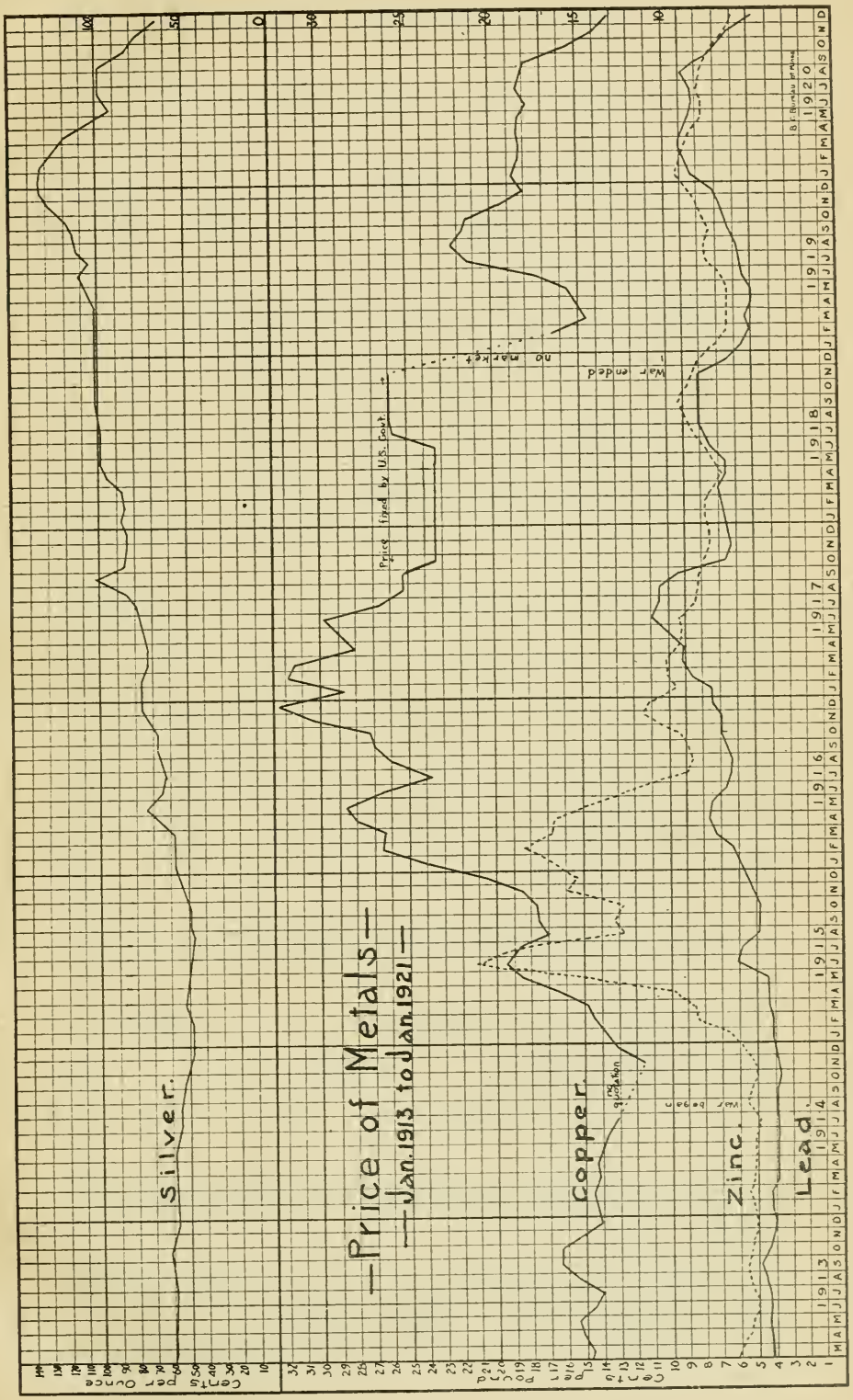
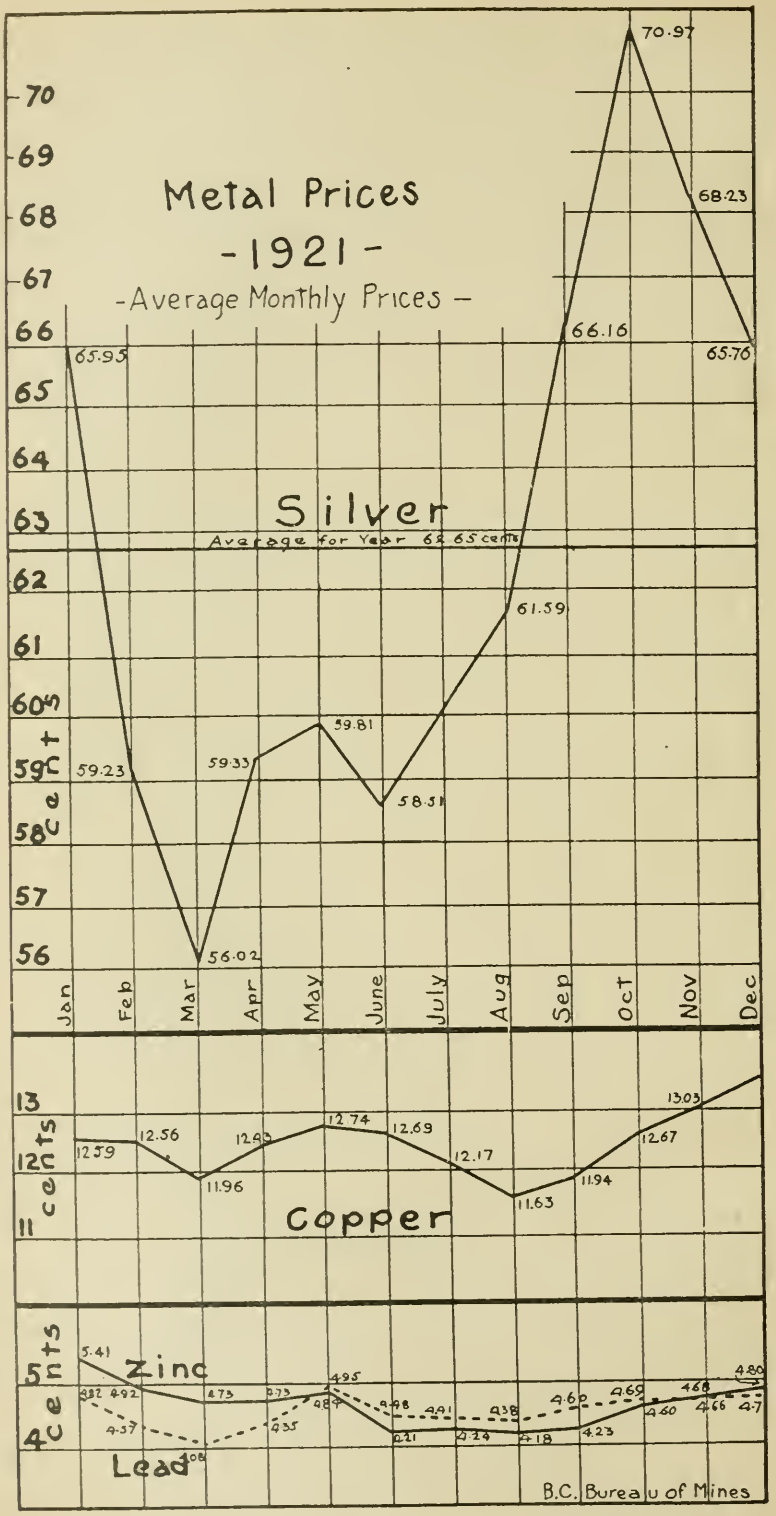
TOTAL MINERAL PRODUCTION
LODE MINES
COAL AND COKE
MISCELLANEOUS
PLACER GOLD


Price of Metals
Jan. 1913 to Jan. 1921
Silver.
Copper.
Zinc.
Lead.
Price fixed by U.S. Govt
War ended
1913
1914
1915
1916
1917
1918
1919
1920


Metal Prices
-1921-
-Average Monthly Prices-
Silver
Average for Year 62.65 cents
Copper
Zinc
Lead
B.C. Bureau of Mines
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
65.95
59.23
56.02
59.33
59.81
58.51
61.59
66.16
70.97
68.23
65.76
12.59
12.56
11.96
12.93
12.74
12.69
12.17
11.63
11.94
12.67
13.03
5.41
4.92
4.73
4.73
4.95
4.38
4.21
4.24
4.18
4.23
4.60
4.69
4.60
4.66
4.80
4.32
4.37
4.35
4.88
4.98
4.91
4.38
4.60
4.69
4.68
4.7
4.08

PROGRESS OF MINING.

The gross value of the mineral production of the Province for the year 1921 was $28,066,641, a decrease from that of the preceding year of $7,476,443, or equivalent to a decrease of about 21.06 per cent.

While this decrease must be admitted, it is extremely gratifying to find that British Columbia's mining industry has been as well maintained as it has, under the phenomenally strenuous conditions that the industry has had to face during the year 1921.

As mining is a business, the condition of the metal market and of the current prices therein is the first essential to the success of the year's business.

The stagnation of the metal market, with its resultant great diminution in the market prices of all the metals, has been a matter of such common knowledge that a great falling-off in the value of the mineral production for the year 1921 was realized as inevitable and arising from world conditions not in any way connected with our mines; the results obtained will prove a very agreeable surprise, in that the discrepancies prove to be much less than was feared they would be, and in comparison with other mining communities we should consider ourselves very fortunate.

To appreciate how strenuous have been the obstacles with which metal-mining has had to contend with this past year, one has to take a broad view of the general conditions as they exist in the world at large, for our conditions cannot be considered a local matter, as they are governed and controlled by world conditions, and we are but a small factor in the world's production of metals.

Europe is the world's metal market, to which practically all export metals find their way. As Europe is the consumer, the industrial conditions of Europe regulate the consumption of and the demand for the metals.

With the unsettled condition of Europe at the present time, Europe cannot buy our metals; with the result that there has been on this continent a greatly overstocked metal market, which has brought about the usual result, a tremendous drop in the market prices of the metals.

To illustrate what this drop has been during the past year, the following table shows the average market prices of the various metals for the years 1920 and 1921:—

Average Metal-market Prices for Year.

	Silver.	Copper.	Lead.	Zinc.
	Cents.	Cents.	Cents.	Cents.
1920	100.90	17.45	7.96	7.67
1921	62.65	12.50	4.54	4.65
Percentage drop in 1921	37.90	28.36	42.90	39.36

To show what this drop in prices actually means, it might be said that, if exactly the same quantities of metals produced in 1920 had had to be sold at 1921 prices instead of 1920 prices, the value of the 1920 product would have been diminished 31 per cent. solely by such lower prices.

This means that in 1920, on an average, the miners received nearly 50 per cent. greater an amount than for a similar quantity of metals in 1921. This is the financial handicap from outside sources that our miners have had to meet throughout the year, and few of them made a profit at these prices, so that the mining companies deserve great credit for the very good output they made.

Towards the end of the year the costs of mining, including wages and supplies, have been materially decreased, so that the outlook for the next year's mining is somewhat brighter.

To indicate how fluctuating the market has been, charts have been prepared to accompany this Report (pages 15 and 16) which show the monthly fluctuations of metal-market prices from 1913 to date.

It is quite apparent from the charts that there has been a great drop from war-days in all metal prices, but, for all this, it is to be noted that the market prices even at the end of the year are not lower than the normal pre-war prices, at which profitable mining was carried on.

During 1921 all the large copper-producers of this continent, by concerted action, reduced their output to about 25 per cent. of normal, or shut down entirely, so as to reduce the stocks of copper on hand; but we now hear of some of these companies preparing to start up again, which is a sign tending to optimism for the future of the copper market, although it is doubtful if the copper market will go higher than 14 cents a pound for some years yet.

There has been a market for copper at a low price, but during most of the year no demand for lead or zinc, and a great amount of such metals in refined state accumulated at the Trail smelter to an extent that prohibited the purchase of such ore by the custom smelters, which cause absolutely shut down many of the Slocan mines.

During the latter part of the year the Trail smelter, it is reported, was fortunate in finding an outlet in the Orient for the greater part of its accumulated lead and zinc stocks on hand, which again permitted prompt cash payment for ores of these metals to be made, and thus again started up these mines in the Slocan, so that it is probable next year will again see these properties working on a normal basis.

In 1921 the tonnage of lead and of zinc produced was greater than in 1920, due to the large production of the Consolidated Mining & Smelting Company's *Sullivan* mine in East Kootenay.

The amount of copper produced was less in 1921 than in 1920 by nearly 6,000,000 lb., but if the *Britannia* mill had not been burned down late in the fall of 1920, and this property—which can ordinarily be counted on for from 15,000,000 to 20,000,000 lb. of copper—being thus temporarily disabled, this year also there would have been an increase in copper production.

The collieries of British Columbia pretty nearly held their own, having made a net coal production of 2,483,995 tons (2,240 lb.), as against 2,595,125 tons in 1920, a decrease of 111,130 tons, equal to about 4.3 per cent.

With the exception of the year 1920, the net coal-output for 1921 is larger than any other year since 1912, or of any previous year, except 1910.

There was no coke produced in the Coast District by the collieries, although the Anyox smelter converted coal into coke for their own use.

The Crowsnest District produced 59,434 tons (2,240 lb.) of coke, of which about two-thirds was used in Canada and one-third exported to the United States.

The aggregate of the values of British Columbia colliery products in 1921 was $12,836,013, this very nearly equalling the gross value of this year's metalliferous products of $13,153,598.

It is noteworthy that the Northern Coast District produced nearly 70 per cent. to the tonnage of ore mined in British Columbia in 1921, carrying about 55 per cent. of the total value of the metalliferous output of the Province.

The following table shows the number of mines which shipped ore during the year 1921, the districts in which they are situated, and the tonnage produced in each district, together with the number of men employed, both above ground and underground.

In explanation of the table it should be said that, in its preparation, a mine employing twelve men for four months is credited in the table with four men for twelve months, so that the total given is less than the actual number of individuals who worked in the mines during the year.

TABLE SHOWING DISTRIBUTION OF SHIPPING MINES IN 1921.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1921.	Men employed in these Mines.		
				Below.	Above.	Total.
CARIBOO DISTRICT:						
Omineca	71	2	..	5	4	9
CASSIAR DISTRICT:						
Atlin, Stikine	55	1	..	4	5	9
Queen Charlotte, Portland Canal, Skeena, and Nass River	1,061,288	7	5	463	392	855
EAST KOOTENAY DISTRICT:						
Fort Steele	298,516	5	3	177	159	336
Windermere-Golden	440	1	1	6	2	8
WEST KOOTENAY DISTRICT:						
Ainsworth	5,523	17	6	52	24	76
Slocan and Slocan City	5,692	20	7	78	62	140
Nelson and Arrow Lake	11,048	4	1	33	26	59
Trail Creek	89,107	5	2	185	56	241
Revelstoke, Lardeau, and Trout Lake	31	2	..	3	1	4
BOUNDARY-YALE DISTRICT:						
Greenwood, Grand Forks, and Osoyoos	41,658	9	5	96	49	145
Similkameen, Nicola, and Vernon	.....	..	..	...	...	...
Yale, Ashcroft, and Kamloops	.....	..	..	...	...	...
LILLOOET DISTRICT	500	1	1	3	10	13
SOUTHERN COAST DISTRICT, V.I.	1,331	5	3	8	9	17
SOUTHERN COAST, MAINLAND	47,385	1	1	104	83	187
Total	1,562,645	80	35	1,217	882	2,099

In the following table of the non-shipping mines the returns are necessarily incomplete, as they include only the mines reporting to the Department, and not the prospects and properties under preliminary development, which in the aggregate give employment to a large number of men.

TABLE SHOWING NON-SHIPPING MINES AND MEN EMPLOYED IN 1921.

District.	Number of Mines.			Men employed.		
	Working.	Idle.	Total.	Below.	Above.	Total.
CARIBOO AND CASSIAR	8	18	26	14	4	18
EAST KOOTENAY	3	11	14	3	4	7
AINSWORTH	6	21	27	12	2	14
SLOCAN	16	35	51	33	8	41
NELSON	7	16	23	9	4	13
TRAIL CREEK	..	5	5	..	1	1
REVELSTOKE-LARDEAU	7	2	9	12	10	22
BOUNDARY-YALE	22	42	64	52	55	107
LILLOOET	1	3	4	1	1	2
SOUTHERN COAST	3	14	17	2	4	6
Totals	73	167	240	138	93	231

SUMMARY OF STATISTICAL TABLES.

Referring to the preceding tables of the mineral production of the Province, the following is a summary of their contents:—

TABLE I. shows the total gross value of each mineral product mined in the Province up to the end of 1921, aggregating $734,259,619. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of $225,409,505; followed next in importance by copper at $166,393,488, and next in order is lode gold at $105,557,977, with placer gold in fourth place at $76,177,403.

TABLE II. shows the value of the total production of the mines of the Province from 1852 to 1892 (inclusive) and for each year from 1893 to 1921 (inclusive), during which period the output increased tenfold, and had a gross production for the year 1921 of $28,066,641.

The value of the total mineral production of the Province up to the end of 1921 was $734,259,619.

TABLE III. gives the quantities in the customary units of measure, and the values, of the various metals or minerals which go to make up the total of the mineral production of the Province, and also, for the purpose of comparison, similar data for the two preceding years.

The table shows that there has been this year an increase in the production of placer gold of $11,600 and an increase in output of lode gold of $322,762, making a total increase of $334,362 in the total production of the precious metal.

The amount of silver produced this past year was 2,673,389 oz., having a gross value of $1,591,201, a decrease in the number of ounces produced of 704,460.

The table shows an output of lead amounting to 41,402,288 lb., valued at $1,693,354, an increase in quantity of 2,071,070 lb., but a decrease in value of $1,122,761.

The production of copper this year was 39,036,993 lb., valued at $4,879,624, a decrease in amount of 5,850,683 lb., or about 13 per cent. The value of the product was less than that of the preceding year by $2,953,275, due to lower prices.

The other metals are specifically mentioned under the headings which follow this summary.

TABLE IV. shows the proportions of the total mineral productions made in each of the various districts into which the Province is divided.

It will be noted that this year the Southern Coast District has again the honour of first place on the list, followed, in order of importance, by the East Kootenay, Cassiar, West Kootenay, and Boundary Districts. The Southern Coast and East Kootenay Districts owe a considerable proportion of their output to the coal-mines situated within their limits, whereas, in the other districts, the production is chiefly from metal-mining.

The Southern Coast District also derives a fair proportion of its production from "Miscellaneous products," such as building materials, etc., due to the larger cities therein; this year this amounted to $1,744,572, as shown in Table V.

TABLE V. is an endeavour to show in some detail the production of those products, such as building materials, previously summarized under "Miscellaneous products," and which amounts this year to $2,077,030. Much difficulty has been found in obtaining reliable figures regarding these products, and in many cases they have had to be estimated; but, while the figures are not as complete as desired, they are at least approximate, and show what an important branch of mineral production this has become, despite the falling-off due to the war and depressed financial conditions.

TABLE VI. shows the statistical record of the placer mines of the Province from 1858 to 1921, and shows a total production of $76,177,403. The output for 1921 was $233,200, an increase, as compared with the previous year, of $11,600.

TABLE VII. relates entirely to the lode mines of the Province, and shows the quantities and values of the various metals produced each year since the beginning, in 1887, of such mining in the Province. The gross value of the product of these mines to date is $397,390,056; this figure includes the zinc production of 1909 and all subsequent years.

TABLE VIII. contains the statistics of production of the coal-mines of the Province. The total net amount of coal produced to the end of 1921 was 56,693,490 tons (2,240 lb.), worth $201,209,783. Of this, there was produced in 1921 2,483,995 tons valued at $12,419,975. In these figures of coal production the coal used in making coke is not included, as such coal is accounted for in the figures of output of coke. The amount of coal used in making coke in 1921 was 85,644 tons, from which was made 59,434 tons of coke, having a value of $416,038, a decrease in amount from the preceding year of 8,358 tons. The total value of the output of the collieries of the Province in 1921 was $12,836,013.

More detailed statistics as to the coal production of the Province and of the separate districts are given elsewhere in this Report.

TABLE IX. gives the details of production of metalliferous mines of the Province for the years 1918, 1919, 1920, and 1921, and the districts in which such productions were made, showing the tonnage of ore mined in each district, with its metallic contents and its market value.

The total tonnage of ore mined in the Province during the year 1921 was 1,562,645 tons, having a gross value of $12,920,398, and, with the placer gold, a total value of $13,153,598.

The following table shows the tonnage derived from the various districts of the Province:—

Cassiar and Omineca District	1,061,414
Southern Coast District	48,716
Boundary-Yale District	41,658
Slocan Mining Division	5,692
East Kootenay District	298,956
Trail Creek Mining Division	89,107
Ainsworth Mining Division	5,523
Nelson Mining Division	11,048
Other Mining Divisions	531
Total	1,562,645

In reports previous to 1910 there has been included in Table IX. the "Miscellaneous products," and in 1910 these were shown distributed to the various districts; the great increase of these products in the past few years has rendered it advisable that this table be reserved exclusively for metalliferous products, and so a new table (No. V.) was introduced in 1911, giving in some detail the output of these miscellaneous products.

In making comparisons of this table with similar tables in previous reports, the fact that "Miscellaneous" has been removed will have to be borne in mind.

Table X. presents in graphic form the facts shown in figures in the tables, and demonstrates to the eye the rapid growth of lode-mining in the Province, and also the fluctuations to which it has been subject.

It will be seen that, although coal-mining has been a constantly increasing industry during this whole period of thirty years, lode-mining did not begin, practically, until 1894, since when it has risen with remarkable rapidity, though not without interruption, until it reached its maximum in 1916, the $31,500,000 line. The total mineral production in 1910 reached the $26,000,000 line, in 1912 it reached the $32,000,000 line, in 1916 the $42,000,000 line, in 1920 it reached the $35,500,000 line, while this year it is just a little above the $28,000,000 line.

GOLD.

Placer Gold.

The recovery of placer gold for 1921 was $233,200, of which practically all was obtained in the Cariboo and Cassiar Districts, only about one-twentieth of the total coming from the other districts. An approximate apportionment is as follows: From Cariboo District, $70,400; Atlin, Stikine, and Liard Divisions of Cassiar District, $146,200; remaining parts of the Province, $16,600. This production for 1921 shows an increase over the preceding year of $11,600, or about 5.2 per cent.

During the past four years the production of placer gold in the Province steadily decreased. The chief reason is to be found in the economic conditions of high prices for labour and supplies, which made placer-mining less profitable than in former years. Shortage of labour also handicapped operations.

Information available regarding the Atlin Division shows that the production was somewhat greater than in 1920, although some of the former operating companies were closed down during the year.

Gold from Lode-mining.

The value of lode gold produced in 1921 was $2,804,154, as compared with $2,481,392 in 1920, an increase of $322,762, or about 13 per cent. During the year 1919 the Granby Company closed its mines and smelter in the Boundary-Yale District and therefore made no production in that district during the past year. The low-grade copper ore handled carried small gold and silver values, and in former years this gold production amounted to a considerable total. The *Nickel Plate* mine in this district also made no production, the mine being closed down in September, 1920, remaining closed during 1921, so the output from this district became negligible.

The Rossland mines, which prior to 1917 contributed annually about one-half of the output of lode gold, made a decreased production in 1920 as compared to the preceding year; but during 1921 somewhat recovered, exceeding the 1920 production, but not reaching that of 1919 by 5,000 oz.

The very small gold-output of the Southern Coast District is due to the shut-down of the *Britannia* mine owing to fire and flood.

The following table shows the gold production of 1919, 1920, and 1921:—

District.	1919.	1920.	1921.
	Oz.	Oz.	Oz.
Cassiar District	60,076	54,531	85,185
Rossland (Trail Creek)	50,229	36,425	44,980
Boundary-Yale	33,526	20,687	735
Coast (Southern)	5,514	6,031	750
Lillooet	2,506	120	374
Nelson	297	1,924	3,587
All others	278	330	52
Totals	152,426	120,048	135,663

From the above table it will be seen that the only districts showing marked increases are the Cassiar, Nelson, and Rossland Districts. In the latter case the increase is small. The output in Cassiar is mainly from the *Surf Inlet* mine, and the new shipper—namely, the *Premier* in the Salmon River section. The outlook for the future in this latter district is most promising and a largely increased production of gold and other metals may be expected.

The increase in Nelson Division is mainly due to the *Nugget* mine being again operated. Developments in this district at present under way may bring the production up again to that of former years.

The production of gold in British Columbia during each of the last four years has only been about one-half of the annual output immediately preceding the war, and shows that gold-mining in this Province has, as elsewhere in the world, been adversely affected by the conditions of high costs and a standard price for the product. Nevertheless, from the developments now in progress it would seem that in a short time the annual production of gold in British Columbia should increase considerably.

SILVER.

The quantity of silver produced was 2,673,389 oz., worth $1,591,201, a decrease from the production of 1920 in quantity of 704,460 oz., and a decrease in value of $1,644,779, or nearly 50 per cent.

The market price of silver gradually and steadily fell during the whole year of 1920, but rose again in 1921. The average price for the year 1920 was 100.9 cents an ounce, while for 1921 it was 62,65 cents.

An accompanying diagram illustrates the fluctuations of market prices (pages 15 and 16).

The following table shows the silver production for 1919, 1920, and 1921:—

District.	1919.	1920.	1921.
	Oz.	Oz.	Oz.
Slocan and Slocan City	1,556,714	738,515	188,142
Skeena, Nass, etc.	920,413	1,317,832	1,563,999
Boundary-Yale	231,599	390,994	160,051
Fort Steele	205,500	362,143	546,631
Ainsworth	167,453	266,963	115,772
Rossland	.....	....	60,184
Coast (Southern)	104,806	93,417	8,548
Omineca	72,573	103,020	3,745
Windermere-Golden	68,634	53,510	18,508
Nelson	44,280	7,065	2,130
All others	31,147	44,390	5,679
Totals	3,403,119	3,377,849	2,673,389

The above table shows an increase in the silver production from the Skeena and Fort Steele Districts, with decreases in all the others.

The greatest increase was made in the Skeena District and is accounted for by new shippers entering the lists. Of these, the *Premier* and the *Alice Arm* mines give promise of swelling the silver production very materially during future years.

The greatest decrease is found in the Slocan District, where mining has been greatly retarded due to the greatly reduced market value of silver and its associated metals, lead and zinc, which latter two metals were nearly unsaleable for most of the year, and has nothing to do with the mines proper.

It is a pleasing surprise to find a very considerable output in the Boundary-Yale District, despite the cutting-off of the production of the Granby and Canada Copper Corporation, which formerly produced 50 per cent. of the silver of the district.

The silver-output of this district this year is chiefly derived from the *Providence*, *Horn Silver*, *Sally*, and *Bell* mines.

COPPER.

The amount of copper produced in 1921 shows, as compared with the previous year, a decrease in quantity, and owing to the lower market selling-price, a still greater decrease in value. The production was 39,036,993 lb., which is 5,850,683 lb. less than the 1920 output; the value for this year is $4,879,624, which, compared with $7,832,899 made in 1920, shows a decrease of $2,953,275.

The demoralized condition of the copper market during 1919 was referred to somewhat fully in the report for that year, so that it is not necessary to further discuss it here.

The following table shows the production of copper, according to districts, in 1919, 1920, and 1921:—

District.	1919.	1920.	1921.
	Lb.	Lb.	Lb.
Cassiar (Skeena, Nass, etc.)	20,411,421	26,153,406	34,841,767
Coast (Southern)	17,062,100	16,311,962	1,456,146
Boundary-Yale	3,835,516	1,306,515	432,505
Trail Creek Division	1,112,133	1,113,085	2,277,392
All others	38,169	2,708	29,183
Totals	42,459,339	44,887,676	39,036,993

From the above table it will be seen that there has been a large increase in the Skeena and in the Trail Creek Division. In the Coast (Southern) District the main producer has been the *Britannia*, and this property mined and milled a larger tonnage in 1920 than in any previous year; but the mine had its mill burned down almost at the beginning of the year, so that it did no productive mining in 1921, thus depriving the district of an expected output of about 15,000,000 lb. of copper and also of considerable gold and silver.

In June, 1919, the Granby Company was forced to close down the low-grade mines at Phoenix and smelter at Grand Forks, resulting in a great decrease in the copper production of Boundary-Yale District.

The Granby Company made an increased production at its mines and smelter at Anyox, with the result that the copper production was greater than that of last year by about 8,000,000 lb.

The *Marble Bay* mine at Vananda was not operated during the year.

The *Rocher Déboulé* mine, in Omineca Division, was closed all year, with the result that practically no copper was produced in that district.

LEAD.

The total amount of lead produced in 1920 was 41,402,288 lb., valued at $1,693,354. This represents, as compared with the previous year, an increase in quantity of 2,071,070 lb., but a decrease in value of $1,122,761.

Immediately after the Armistice and during early part of 1919 the price of lead in New York fell to 5 cents, but by the end of the year had gradually risen to 8 cents, and remained at about

that price until September, 1920, when, in company with all the other metal prices, it fell rapidly, and at end of the year had reached the pre-war standard of about 4 cents. The average price for 1921 was 4.54 cents.

The following table shows the production of lead, according to districts, for the years 1919, 1920, and 1921:—

District.	1919.	1920.	1921.
	Lb.	Lb.	Lb.
Fort Steele	10,729,483	26,926,319	38,066,820
Slocan	12,156,845	6,135,581	1,614,425
Ainsworth	4,336,602	4,072,807	1,264,845
Windermere-Golden	1,659,279	1,095,486	385,000
Nelson	292,010	719,219	1,301
Grand Forks	.....	.....	51,268
All others	301,749	381,806	18,629
Totals	29,475,968	39,331,218	41,402,288

From the above table it will be seen that there was an increase in Fort Steele and a decrease in all other districts.

The Fort Steele District this year made an output over treble that of 1919, and this year leads all the other districts, producing over 90 per cent. of total lead-output of Province. This great increase is due to the great output of the *Sullivan* mine, owned by the Consolidated Mining and Smelting Company, of Trail. The *North Star* mine produced about 41,202 lb. lead.

In the Slocan District the heaviest producer in 1921 was the *Silversmith*, followed by the *Rosebery-Surprise* and *Standard*.

In the Ainsworth Division the largest producer was the *Florence*, with an output of about 610,205 lb., followed by the *Bluebell*, with approximately 379,520 lb., and thirteen smaller shippers.

The production from Windermere-Golden was chiefly from the *Paradise* mine, with a production of about 385,000 lb.

ZINC.

The quantity of zinc produced in 1921 amounted to 49,419,372 lb., which, compared with 47,208,268 lb. produced in 1920, shows an increase of 2,211,104 lb. This production is valued at $1,952,065, which shows a decrease, as compared with the 1920 value, of $1,125,914, or about 37.5 per cent.

The zinc market was not as much affected as the copper and lead markets by the transition period from war demands to peace conditions, with the result that the price of the metal did not fluctuate greatly and production continued uninterruptedly.

During the latter half of 1920, although the prices of the metal were sustained, there were but small sales and the market for zinc ore disappeared, while many zinc-smelting plants and mines on this continent closed down temporarily at least.

The average price in New York for the year 1921 was about 4.65 cents a pound; the market price at end of the year was about 4.85 cents.

The following table shows the production of zinc, according to districts, for the years 1919, 1920, and 1921.

District.	1919.	1920.	1921.
	Lb.	Lb.	Lb.
Fort Steele	46,460,703	42,881,092	49,319,198
Slocan	10,015,624	3,715,471	65,984
Omineca	224,539	453,512	11,561
Ainsworth	36,785	158,193	22,629
All others	.....	.....	.....
Totals	56,737,651	47,208,268	49,419,372

Some uncertainty was felt as to the production of zinc this year, as labour troubles have been general in the zinc-producing districts and considerable ore has been shipped to the United States.

From the above table it would seem that practically all of the zinc ore mined in the Province this last year was from the Fort Steele District. The output in this district was made chiefly by the *Sullivan* mine, and was due to a large tonnage being sent to the Consolidated Company's electrolytic zinc-refinery at Trail, where the ore is treated.

In the Slocan District the heaviest shipper was the *Bosun*, with a production of 52,612 lb. The next largest shipper was the *Canadian*, followed by the *Ivanhoe*.

The figures for Ainsworth show a greatly decreased production.

The Omineca production is entirely a silver-zinc concentrate from the *Silver Standard* mine at Hazelton.

OTHER MINERALS.

Iron. So far there has been no metallic iron produced in British Columbia, but it has been strongly advocated in many quarters that the conditions are favourable for the establishment of an iron-smelting plant somewhere on the British Columbia coast. So far nothing definite has materialized, although there is apparently a prospect of such a plant being established. As is well known, there is on the Coast, in the aggregate, an adequate supply of magnetite-iron ore, quite sufficiently free from impurities as to be within the "Bessemer limit" to supply ore for such a plant.

Further investigation of the Taseko limonite-deposits was made during 1920 by a party sent out by the Department of Mines. The deposits were also examined in detail by Dr. J. D. MacKenzie, of the Geological Survey of Canada.

The only shipments of iron ore made this past year were 985 tons from the *Good Hope*, Texada island, and 25 tons from the Puget Sound Iron Company, Texada island.

Platinum. The well-known fact of the wide occurrence of platinum throughout the Province in connection with our placer-gold deposits gives reasonable hope that such may be found in payable quantities and justifies further investigations. As far as reports received indicate, the only output this year is about $100 worth from the Similkameen District.

Molybdenite. Since the Armistice the market is dormant, like other metal prices, but nominal quotations vary from 45 to 50 cents a pound. No advice has been received of any shipment this year.

Chromite. In 1918 about 800 tons of chromite ore, carrying from 30 to 45 per cent. chromic oxide, was shipped from the *Mastodon* claim, Grand Forks Division; and a deposit on Scottie creek, near Clinton, was opened up, but no shipments were made. With the end of the war the market for chromite temporarily collapsed, as large stocks were available, with no purchasers in sight. It is believed that no ore was shipped since that date.

No manganese was produced in 1921.

Non-metallic Minerals. About 6,742 tons of fluorspar concentrates was shipped from the *Rock Candy* group, in the Grand Forks Division. This property is owned by the Consolidated Mining and Smelting Company and is equipped to make steady shipments in the future. The growth of this property has been very interesting during the last two or three years. The property is now equipped with an efficient concentrating mill, which produced concentrates carrying about 88.5 per cent. calcium fluoride and 5.3 per cent. silica, and having a total value of about $157,000. The mineral is shipped to Trail smelter and is used for making hydrofluoric acid, which is used in the lead-refinery, and to other points in Canada and to the United States.

The Lillooet Soda Company produced 200 tons of sodium carbonate.

Deposits of hydromagnesite in the Clinton Division, which are reported to be large and of great purity, have attracted considerable attention during the past year. A shipment of 1,000 tons was made to Vancouver.

No arsenic was produced in 1921.

Talc.—Some 167 tons of talc was mined and ground in the Victoria Mining Division, for which product there appears to be a large demand.

Iron Pyrites.—At the *Sullivan* mine in East Kootenay some 1,121 tons of iron pyrites was mined and shipped to Trail.

COAL.

The gross production of coal in 1921 was 2,569,639 long tons, of which 85,644 tons was made into coke, leaving the net production at 2,483,995 tons. These figures show a decrease, as compared with 1920, of 127,135 tons gross and of 111,130 tons net. The quantity of coke made was 59,434 tons, which is a decrease of 8,358 tons as compared with 1920. For purposes of comparison the following table is shown:—

	1916.	1917.	1918.	1919.	1920.	1921.
Coal, gross.....tons, 2,240 lb..	2,485,580	2,398,715	2,578,724	2,408,948	2,696,774	2,569,639
Less made into coke "	401,487	248,740	276,479	141,407	101,649	85,644
Coal, net..... "	2,084,093	2,149,975	2,302,245	2,267,541	2,595,125	2,483,995
Coke made..... "	267,725	159,905	188,967	91,138	67,792	59,434

Summarizing the Provincial gross production of coal, the following table shows the output:—

	1918.	1919.	1920.	1921.
Vancouver Island mines.....tons, 2,240 lb.	1,666,211	1,699,348	1,698,254	1,625,931
Nicola and Similkameen mines..... "	179,179	149,042	149,731	183,153
Crowsnest mines..... "	732,864	558,806	847,389	759,755
Omineca-Telkwa .... "	470	1,752	1,400	800
Total quantity of coal mined.. "	2,578,724	2,408,948	2,696,774	2,569,639
Less made into coke..... "	276,479	141,407	101,649	85,644
Net quantity of coal produced "	2,302,245	2,267,541	2,595,125	2,483,995

In addition to the above net production of coal, there was made by the collieries the coke production shown in the following table:—

	1918.	1919.	1920.	1921.
Vancouver Island collieries.....tons, 2,240 lb.	24,887	34,071	*Nil*	*Nil*
Nicola and Similkameen collieries... "	*Nil*	*Nil*	*Nil*	*Nil*
Crowsnest District collieries..... "	164,080	57,067	67,792	59,434
Total coke production.. ... "	188,967	91,138	67,792	59,434

As will be seen from the above figures, the net coal production this year is 111,130 tons less than it was in 1920, and greater than it has been since 1912, except in 1920.

The greater part of the gross Provincial coal production is still being mined by three companies—the Crow's Nest Pass Coal Company of East Kootenay, the Canadian Collieries (Dunsmuir), and the Western Fuel Corporation of Vancouver island, which mined, collectively, 77 per cent. of the gross output.

Of the other collieries: In the Coast District, on Vancouver island, the Pacific Coast Coal Mines, Limited, produced only 29 tons, having been in litigation; the Nanoose Collieries, Limited, 50,206 tons; and the Granby Company, from their colliery near Cassidy, produced 268,962 tons. In the Nicola Valley section of the district, the Middlesboro Colliery Company mined 67,792 tons; the Fleming Coal Company, 35,391 tons; the Princeton Coal and Land Company, 13,966 tons; the Coalmont Colliery, 63,344 tons; and the Chu Chua Colliery, 2,160 tons of coal.

A new coalfield has been opened up in the Omineca District, where a small colliery is being developed on the Telkwa river that last year shipped 800 tons of coal. For convenience this has been included in the Coast District figures.

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 691,824 tons, the Corbin Coal and Coke Company produced 67,931 tons.

The collieries of the Coast District, including the Nicola-Princeton and Telkwa fields, are to be credited this year with about 70 per cent. of the total coal-output.

The gross output of the collieries of the Province for the past year was, as already stated, 2,569,639 tons; there was also 4,718 tons of coal taken from stock.

Of this gross amount, there was sold for consumption in Canada, 1,269,566 tons; sold for consumption in the United States, 815,441 tons; sold in other countries, *nil;* making the total coal sales for the year 2,085,007 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 85,644 tons, and used under companies' boilers, etc., 213,558 tons; while 190,148 tons was lost in washing and screening.

The coke sales of the Province for the past year amounted to 59,970 tons, of which 536 tons was taken from stocks on hand.

The following table indicates the markets in which the coal and coke output of the Province was sold:—

Coal.	Coast District.	Crowsnest Pass District.	Total for Province.
Sold for consumption in Canada ..... tons, 2,240 lb.	1,165,305	104,261	1,269,566
" export to United States ..... "	320,110	495,331	815,441
" export to other countries ..... "	.....	.....	.....
Total coal sales	1,485,415	599,592	2,085,007
Coke.			
Sold for consumption in Canada ..... tons, 2,240 lb.	.....	41,878	41,878
" export to United States ..... "	.....	18,092	18,092
" export to other countries ..... "	.....	.....	.....
Total coke sales	.....	59,970	59,970

Collieries of Coast District.

The collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields, and a small colliery on Telkwa river mined 1,809,884 tons of coal in 1921, in addition to which 18,577 tons was taken from stock, making 1,828,461 tons distributed from these collieries in 1921. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	1,165,305	
Sold as coal in United States	320,110	
Sold as coal in other countries	*Nil.*	
Total sold as coal		1,485,415
Used under companies' boilers, etc.		152,898
Used in making coke		.....
Lost in washing, etc.		190,148
		1,828,461
Minus coal taken from stock		18,577
Gross output		1,809,884

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, a decrease of 14,112 tons, equivalent to about 1 per cent.

The coal sold in Canada by the collieries of the Coast District this year shows a decrease of 13,624 tons, or about 1.15 per cent. from the preceding year; the amount exported to the United States was 7,159 tons more than the preceding year, an increase of about 2.2 per cent.

There was no coke produced in the Coast District this year.

On Vancouver island five companies produced coal this year—the Canadian Collieries, Limited, the Canadian Western Fuel Company, the Granby Consolidated Mining, Smelting, and Power Company, the Pacific Coast Coal Mines, and the Nanoose Collieries, Limited; the majority of these companies each operate two, or more, collieries. The combined gross output of the Island collieries was 1,625,931 tons.

In the Nicola and Princeton coalfields of the Coast District, the Middlesboro Colliery Company produced 67,792 tons of coal; the Fleming Coal Company, 35,891 tons; the Princeton Colliery, 13,966 tons; the Coalmont Collieries, 63,344 tons; and the Chu Chua Collieries, 2,160 tons.

The total output of this portion of the sub-district was 183,153 tons. The Telkwa Collieries produced 800 tons.

East Kootenay Coalfield.

There were only two companies operating in this district this past year—the Crow's Nest Pass Coal Company, operating two separate collieries, the combined output of which was 691,824 tons; and the Corbin Coal and Coke Company, which made an output of 67,931 tons; making a gross output for the district for 1921 of 759,755 tons of coal.

Of the coal mined, 13,859 tons was added to stock, making the amount of coal distributed from the collieries 745,896 tons.

Of this gross tonnage, 85,644 tons was used in the manufacture of coke, of which there was produced 59,434 tons (2,240 lb.).

The coke sold this year amounted to 59,970 tons, in addition to which 536 tons was taken from stock.

The following table shows the distribution made of the coal of this district:—

	Tons.	Tons.
Sold as coal in Canada	104,261	
Sold as coal in United States	495,331	
Total sold as coal		599,592
Used by the companies in making coke		85,644
Used by the companies under boilers, etc.		60,660
		745,896
Plus coal added to stock		13,859
Gross output		759,755

BUILDING MATERIALS.

The output during 1921 of structural materials, such as cement, lime, building-stone, sand and gravel, brick and other clay products, was less than in the preceding year, being $1,903,799 as against $2,176,460.

Approximately 90 per cent. of the total production of building materials comes from the Coast District, and the larger part of this finds its markets in the Coast cities.

It is probable that an output amounting to about $1,500,000 represents the steady yearly demand for these materials for use in repairs, renewals, and various small demands, with but little new construction-work.

Cement production is less than 1920.

Building-stone. Public works and several large buildings have caused the quarrying of a good deal of building-stone, and the production in 1921 is valued at $233,650.

Excellent building-stone of various sorts is found in abundance in almost every part of the Province; the fact of its widespread distribution has, however, been somewhat against the establishment of large quarrying industries, as a sufficient local supply could always be obtained, and, except within reach of the larger cities, few regularly equipped quarries have been opened.

On the Coast, chiefly between Vancouver island and the Mainland, there are several well-equipped quarries taking out granite, sandstone, and andesite, all of excellent quality. These quarries supply the stone building material of the Coast cities, and have also exported to the United States.

A detailed description of the more important quarries was given in the Report of this Bureau for 1904.

Red Brick. The sale of red brick during the past year was about 6,000 M.; the price varies from $12 to $18 a thousand, according to quality and demand. This small output shows very clearly that but little construction-work has been carried on. It is probable, however, that a considerable quantity of brick is still imported into the Province.

Firebrick. The only company producing firebrick in the Province is the Clayburn Company, Limited, with a plant at Clayburn. The fireclay is found here as a bed occurring in bedded rocks of Eocene age. Shales, sandstones, and conglomerates, all but little consolidated, make up this sedimentary series. The shales are quarried or mined for brick-making and one bed is an excellent fireclay. Associated with these rocks is a bed of lignite which is sufficiently good to be used for firing the boilers of the plant. Firebrick is the principal manufactured article produced by this company, but, in addition, considerable quantities of common brick, paving-brick, tiles, drain-pipes, and prepared fireclay are made.

Lime. The manufacture of lime is conducted in a small way at a large number of points in the Province, but only on the Coast has any attempt been made at more extensive operations. In the neighbourhood of Victoria, on Esquimalt harbour, two kilns are in operation, and there are two kilns on Saanich inlet. On Texada island —in addition to the plant at Marble bay—a new and extensive plant was erected at Blubber bay a few years ago. The limestone being used is of exceptional purity, but in some instances the limestone-beds are cut by igneous dykes which have to be rejected, and this somewhat increases the cost of quarrying.

The production of lime and limestone for 1921 is valued at $299,191, as compared with $338,151 in 1920; of this about $25,865 worth of limestone was quarried for use as smelter flux by the Granby and Consolidated Companies and $19,595 worth quarried by the paper and pulp mills for their own use.

Portland Cement. There were two large and well-equipped cement plants in the Province, both situated on Saanich inlet. These two concerns have recently been amalgamated under the name of the British Columbia Cement Company, with plant at Tod inlet, which made a production in 1921 of over $600,000. Portland cement is thus the most important item in the production of building materials.

Crushed Rock and Gravel. The returns for crushed rock and gravel indicate an increased demand for this material, although some of the plants have not been in operation for the past two or three years. During the boom years of 1911 and 1912 a number of well-equipped plants were put up near Vancouver and Victoria for supplying washed sand and gravel, properly screened to size. Some of these companies use a system of mining the gravel by hydraulic streams and carrying the product to the screens by the water used.

BUREAU OF MINES.

WORK OF THE YEAR.

The work of the Bureau of Mines naturally increases year by year, this growing activity being due to the following causes: The extension of the mining area of the Province, with the proportional increase in the number of mines; the increasing desire of the outside public for the free information which the Bureau supplies with regard to the various mining districts and camps, and the appreciation by the prospector of the fact that he may obtain, gratis, a determination of any rock or mineral which he may send to the Bureau.

The routine work of the office, and the preparation and publication of the Report for the year just ended, followed by the examination in the field of as many of the mines and mining districts as the season would permit, together with the work of the Laboratory, fully occupied the staff for the year.

The permanent staff of the Bureau now consists of the Provincial Mineralogist and Assayer, Wm. Fleet Robertson; the Assistant Provincial Assayer and Provincial Analyst, D. E. Whittaker; John Adams as Laboratory Assistant; H. T. Nation, general office assistant; and H. Pearson, clerk.

MINERAL SURVEY DISTRICTS AND RESIDENT ENGINEERS THEREOF.

During the session of 1917 the Hon. the Minister of Mines brought in the "Mineral Survey and Development Act," which was passed on May 19th, 1917, and under the provisions of which the Province was divided into six Mineral Districts, to each of which there was appointed a Resident Engineer with headquarters at a centrally located point in such district.

In the district to which he was appointed the Resident Engineer is expected to devote his whole time to the performance of the duties of his office, and to carry on continuously a mineral survey of his district, keeping records of the same and of the mining and mineral developments taking place, and at the same time to assist prospectors and others with such advice as may be necessary and may come within the scope of a mining engineer's work.

Aside from special reports which may be called for by the Minister, the Resident Engineers are expected annually to make a comprehensive report covering all matters relating to mining, mine development, and prospecting that have occurred within the year in their respective districts.

These annual reports of the Resident Engineers are given later in this general Report, and form the basis of the information given in respect to the mineral industry and its development within the Province.

The following are the six Mineral Districts into which the Province is divided, with the Mining Divisions included in each and the location of the permanent office of the district, with the name of the Resident Engineer appointed to each district:—

The North-western Mineral Survey District (No. 1) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Atlin, Stikine, Liard, Skeena, Nass River, Portland Canal, Bella Coola, and Queen Charlotte; and shall have its permanent survey station and office at the City of Prince Rupert. Resident Engineer, Geo. A. Clothier, B.Sc.

The North-eastern Mineral Survey District (No. 2) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Omineca, Peace River, Cariboo, and Quesnel; and shall have its permanent survey station and office at Hazelton. Resident Engineer, John D. Galloway, M.Sc.

The Central Mineral Survey District (No. 3) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale; and shall have its permanent survey station and office at the City of Kamloops.

It is with much regret that it has to be reported that R. W. Thomson, who has been the Resident Mining Engineer of this district since its establishment in 1917, died at Kamloops on January 6th, 1922, after a lingering illness. A successor to the position has not as yet been appointed.

The Southern Mineral Survey District (No. 4) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Similkameen, Greenwood, Grand Forks, and Osoyoos; and shall have its permanent survey station and office at the City of Grand Forks. Resident Engineer, Philip B. Freeland.

The Eastern Mineral Survey District (No. 5) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Golden, Windermere, Fort Steele, Ainsworth, Slocan, Slocan City, Trout Lake, Nelson, Arrow Lake, Revelstoke, Lardeau, and Trail Creek; and shall have its permanent survey station and office at the City of Revelstoke. Resident Engineer, A. G. Langley, B.Sc.

The Western Mineral Survey District (No. 6) shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver, and New Westminster; and shall have its permanent survey station and office at the City of Nanaimo. Resident Engineer, W. M. Brewer.

ASSAY OFFICE.

The following is a summary of the work of the Assay Office of the Bureau of Mines for the year 1921 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1921 there were made by the staff in the Government Assay Office, 3,455 assays or quantitative determinations; of these the majority were for the Bureau of Mines or for the other departments, for which no fees were received.

The fees collected by the office were as follows:—

Fees for analyses	$ 513 55
Fees for assaying	66 50
Fees for assayers' examinations	240 00
Total cash receipts	$ 820 05
Determinations and examinations made for other Government departments for which no fees were collected—	
Attorney-General's Department	$ 712 00
Agricultural Department	585 00
Board of Health	258 00
Treasury Department	16 65
Other departments	215 00
	$1,786 65
Value of work done outside of Mines Department work	$2,606 70

The value of gold melted during the year 1921 was $775 in 11 lots, as against $3,116 in 15 lots in 1920.

Free Determinations.

In addition to the above quantitative work, a large number of qualitative determinations, or tests, were made in connection with the identification and classification of rocks or minerals sent to the Bureau for a report; of these no count was kept, nor were any fees charged, as it is the established custom of the Bureau to examine and test qualitatively, without charge, samples of minerals sent in from any part of the Province, and to give a report on the same. This has been done for the purpose of encouraging the search for new or rare minerals and ores, and to assist prospectors and others in the discovery of new mining districts, by enabling them to have determined, free of cost, the nature and probable value of any rock they may find. In making these free determinations, the Bureau asks that the locality from which the sample was obtained be given by the sender.

EXAMINATIONS FOR ASSAYERS.

REPORT OF D. E. WHITTAKER, SECRETARY OF BOARD OF EXAMINERS.

I have the honour, as Secretary, to submit the Annual Report for the year 1921 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act Amendment Act, 1899."

Examinations were held in Victoria, in the Government Laboratory, on April 11th, May 17th, and December 12th and the following days. Thirteen candidates came up for examination. Seven obtained the required number of marks and the Board recommended that Certificates be granted to them. Three candidates applied for exemption under section 2, subsection (2), of the Act, and the Board recommended that Certificates be issued to them.

In accordance with the recommendation of the Board, Certificates have been duly issued by the Honourable the Minister of Mines to the ten candidates.

LIST OF ASSAYERS HOLDING PROVINCIAL CERTIFICATES OF EFFICIENCY UNDER THE "BUREAU OF MINES ACT AMENDMENT ACT, 1899."

(Only the holders of such certificates may practise assaying in British Columbia.)

Under section 2, subsection (1).

Adams, J. B. .....Victoria.
Archer, E. G. .....Anyox.
Armstrong, N. .....Vancouver.
Ayres, D. A. .....
Austin, John W. .....Vancouver.
Backus, Geo. S. .....Britannia Beach.
Baker, C. S. H. .....
Bagus, N. J. .....Vancouver.
Barke, A. C. .....
Beilby, E. B. .....Vancouver.
Bernard, Pierre .....Monte Christo, Wash.
Bishop, Walter .....Grand Forks.
Broughton, F. W. .....Vancouver.
Buchanan, James .....Trail.
Buehman, A. S. .....Trail.
Campbell, Colin .....New Denver.
Carmichael, Norman .....Clifton, Arizona.
Church, George B. .....
Clarke, E. R. .....Vancouver.
Cobeldick, W. M. .....Scotland.
Collison, H. .....Cobham, England.
Comrie, George H. .....Vancouver.
Craufurd, A. J. F. .....Rossland.
Crerar, George .....
Crompton, S. V. .....Vancouver.
Cruickshank, G. .....
Davidson, J. R. .....Vancouver.
Day, Athelstan .....Dawson.
Dedolph, Ed. .....
Dockrill, Walter R. .....Chemainus.
Dunn, G. W. .....Rossland.
Farquhar, J. B. .....Vancouver.
Fingland, John J. .....Kaslo.
Gardner, C. S. .....Victoria.
Grosvenor, F. E. .....Vancouver.
Hamilton, Wm. J. .....Anyox.
Hannay, W. H. .....Rossland.
Harsant, R. C. C. .....Port Essington.
Hart, P. E. .....
Hawkins, Francis .....Silverton.
Hawes, F. B. .....Vancouver.
Hodgson, A. R. .....Anyox.
Hook, A. Harry .....Greenwood.
Hurter, C. S. .....Prince Rupert.
Irwin, George E. .....Vancouver.
John, D. .....Haileybury, Ont.
Kiddie, Geo. R. .....California.
King, R. .....
Kitto, Geoffrey B. .....Victoria.
Lang, T. F. .....Vancouver.
Langley, A. S. .....Crofton.
Laucks, I. F. .....Seattle.
Lee, Fred E. .....Trail.
Lee, Geo. M. .....Grand Forks.
Ley, Richard H. .....Victoria.
Levy, Frank .....
Lindsay, W. W. .....Kimberley.
Locke, V. F. .....Vancouver.
Longworth, F. J. .....Boyds, Wash.
Manning, S. M. .....Trail.
Martin, S. J. .....
Marsh, Richard .....Republic, Wash.
Marshall, H. Jukes .....Vancouver.
Marshall, William S. .....Ladysmith.
Meale, Eric A. .....East Helena, Mont.
Merrifield, T. T. .....Trail.
Miles, Arthur D. .....
Milne, A. S. .....Vancouver.
Mitchell, Charles T. .....Copper Cliff, Ont.
McCormick, Alan F. .....Ruth, Nevada.
MacDonald, Alec C. .....Vancouver.
McLellan, R. D. .....Vancouver.
Morgan, Richard .....Trail.
Nicholls, Frank .....Norway.
Okell, S. E. .....Vancouver.
Parker, Robt. H. .....
Parsenow, W. L. .....
Perkins, Walter G. .....
Pickard, T. D. .....Vancouver.
Pirrie, Noble W. .....Ottawa, Ont.
Poole, H. W. .....Vancouver.
Prior, C. E. .....Hedley.
Richmond, Leigh .....Duncan.
Robertson, T. R. .....
Rodgers, Ch. B. .....Vancouver.
Rombauer, A. B. .....Butte, Mont.
Schroeder, Curt A. .....
Segsworth, Walter .....Toronto, Ont.
Shepherd, G. H. .....North Vancouver.
Sharpe, Bert N. .....
Shore, J. T. .....Vancouver.
Sim, Chas. John .....Monte Carlo.
Sloan, Wm. .....Vancouver.
Snyder, Blanchard M. .....
Steven, Wm. Gordon .....
Stimmel, B. A. .....Trail.
Stockly, Galt .....Princeton.
Sundberg, Gustave .....Mexico City.
Tally, Robert E. .....Spokane, Wash.
Taylor, E. S. .....Vancouver.

Under section 2, subsection (1)—Continued.

Taylor, H. L. .....Vancouver.
Teed, A. J. .....Vancouver.
Thirkell, V. R. .....Vancouver.
Thomas, Percival W. .....Vancouver.
Tretheway, John H. .....
Turner, H. A. .....Vancouver.
Vance, John F. C. B. .....Vancouver.
Van Agnew, Frank .....Siberia.
Vaughan-Williams, V. L. ..California.
Wales, Roland T. .....
Watson, Wm. J. .....Ladysmith.
Watson, Thomas .....Vancouver.
Welsh, J. Cuthbert .....Butte, Mont.
Wells, Ben T. .....
West, Geo. G. .....Vancouver.
Whittaker, Delbert E. .....Victoria.
Widdowson, E. Walter ....Nelson.
Willemar, Douglas R. .....New Hazelton.
Williams, W. A. .....Vancouver.
Williams, Eliot H. .....
Williams, J. R. .....Vancouver.
Wimberley, S. H. .....Nevada, U.S.A.
Youngs, T. N. .....Victoria.

Under section 2, subsection (2).

Archer, Allan .....
Baylock, Selwyn G. .....Trail.
Bissett, D. G. .....Trail.
Bolton, George E. .....Silverton.
Brennan, Charles Victor ...Victoria.
Browne, R. J. .....Rossland.
Browne, P. J. .....Nelson.
Bryant, Cecil M. .....
Burwash, N. A. .....
Cavers, Thomas W. .....
Clothier, George A. .....Prince Rupert.
Cole, Arthur A. .....Cobalt, Ont.
Cole, G. E. .....Rossland.
Cole, L. Heber .....Ottawa, Ont.
Conway, E. J. .....Vancouver.
Coulthard, R. W. .....
Cowans, Frederick .....
Dawson, V. E. .....Trail.
Dempster, R. C. .....Rossland.
Dempster, A. S. .....Rossland.
Dixon, Howard A. .....Toronto, Ont.
Eardley-Wilmot, V. L. .....Rossland.
Eldridge, Gardner S. .....Vancouver.
Galbraith, M. T. .....
Gilman, Ellis P. .....Vancouver.
Gray, Stanley .....Trail.
Green, J. T. Raoul .....Blairmore, Alta.
Guess, George A. .....Toronto, Ont.
Gwillim, J. C. .....Kingston, Ont.
Harding, Wilson M. .....
Heal, John H. .....
Hearn, Roy D. .....Trail.
Hilliary, G. M. .....Idaho, U.S.A.
Johnston, William Steele...Lachine, Que.
Kaye, Alexander .....Vancouver.
Kendall, George .....Vancouver.
Kidd, G. L. .....Edmonton, Alta.
Kilbourne, Geo. H. .....Rossland.
Lathe, Frank E. .....Grand Forks.
Lay, Douglas .....Rossland.
Lewis, Francis B. .....South Africa.
Merrit, Charles P. .....
Murphy, C. J. .....St. Catharines, Ont.
Musgrave, W. N. .....England.
McArthur, Reginald E. ....
McDiarmid, S. S. .....
McGinnis, Wm. C. .....Queen Charlotte Ilds.
McKay, Robt. B. .....Vancouver.
McLellan, John .....Queen Charlotte Ilds.
McMurtry, Gordon O. .....
McNab, J. A. .....Thompson, Nevada.
McPhee, W. B. .....
McVicar, John .....Edmonton, Alta.
Maclennan, F. W. .....
Macdonald, J. S. .....Vancouver.
Moran, P. J. .....Vancouver.
Newton, W. E. .....Sandon.
Oliver, Chas. E. .....Vancouver.
Oughtred, S. W. .....Ainsworth.
Outhett, Christopher .....Kamloops.
Pemberton, W. P. D. .....Victoria.
Reid, J. A. .....Cobalt, Ont.
Ritchie, A. B. .....Nelson.
Roaf, J. R. .....
Roscoe, Harold M. .....Anyox.
Rose, J. H. .....Thompson, Nevada.
Rutherford, R. C. .....Trail.
Sampson, E. H. S. .....Riondel.
Scott, John Mitchell .....Stewart.
Scott, Oswald Norman ....
Shannon, S. .....
Sharpe, G. P. .....Midland, Ont.
Shorey, P. M. .....Trail.
Sloan, David .....Three Forks.
Stevens, F. G. .....Mexico.
Stewart, A. G. .....Vancouver.
Stroud, J. E. C. .....Anyox.
Sullivan, Michael H. .....Kellogg, Idaho.
Sutherland, T. Fraser .....
Sutherland, Wm. .....Glasgow, Scotland.
Swinney, Leslie A. E. .....
Thompson, W. K. .....Trail.
Thomson, H. Nellis .....Anaconda, Montana.
Thomson, Robt. W. (deceased)
Watson, A. A. .....
Watson, Henry .....
Willis, F. S. .....Trail.
Winslow, R. H. .....Vancouver.
Wilson, Ridgeway R. .....Victoria.
Workman, Ch. W. .....
Wright, Richard .....Rossland.
Wynne, Llewellyn C. .....
Yuill, H. H. .....

Under section 2, subsection (3).

Carmichael, Herbert .....Victoria.
Galloway, J. D. .....Victoria.
(Resident Engineer.)
Harris, Henry .....Tasmania.
Hedley, Robt. R. .....Vancouver.
Kiddie, Thos. .....California.
Marshall, Dr. T. R. .....London, England.
McKillop, Alexander .....Vancouver.
Pellew, Harvey, Wm. .....London, England.
Robertson, Wm. Fleet .....Victoria.
(Provincial Mineralogist.)

Previously issued under the "Bureau of Mines Act, 1897," section 12.

Pinder, B. .....
Thompson, James B. .....Vancouver.

NORTH-WESTERN DISTRICT (No. 1).

REPORT OF GEO. A. CLOTHIER, RESIDENT ENGINEER.

INTRODUCTORY.

This district comprises the following eight Mining Divisions of the Province: Bella Coola, Skeena, Queen Charlotte, Nass River, Portland Canal, Stikine, Liard, and Atlin. The southern portion of the district, from Seymour inlet to Portland canal, lies west of the Coast Range summit. The northern portion lies east of the Coast Range summit which forms the Alaska-British Columbia boundary-line, and is therefore behind the Alaska strip. There is consequently a great diversity of geological and geographical conditions which are very favourable for prospecting and mining operations. These conditions have been described in preceding reports, but I think their importance justifies a brief review of their more salient features in this report for the information of new readers, at the risk of uninteresting repetition for readers of former reports.

The chief geological features are the three immense belts, running north-west and south-east, into which the district may be divided. Of these, the all-important one is the granite Coast range of mountains, extending the full length of the Province to near the head of Lynn canal, from which point it gradually merges into the Yukon plateau about Kluane lake. The range is from 60 to 100 miles in width, and its intrusion through the sedimentary formation has created exceptionally favourable conditions along its borders for the circulation of ascending, heated, mineral-bearing solutions and the deposition of their mineral loads, comparatively near the surface, under conditions of diminishing temperature and pressure.

For the purpose of this report, the zone along the eastern border of the granite range is called the Eastern Contact Belt and that west of the range the Western Contact Belt.

The only access to the Eastern Contact Belt in this district is from the Coast, and, unfortunately, the major portion of the belt is behind the Alaska strip, which rather complicates matters in the construction of roads and trails. The Coast range is, however, penetrated in several places by rivers and inlets to its eastern border and can therefore be reached in spots—up the Skeena river (Canadian National Railway); up the Nass river as far as Ayansh; to the heads of Observatory inlet and Portland canal; up the Unuk river; up the Taku river; and from Skagway over the White Pass Railway to the Atlin country.

The principal developments so far have been at Anyox and Alice Arm, at the head of Observatory inlet; Stewart, at the head of Portland canal; and Atlin, at the extreme north end of the Province, about 250 miles from Stewart. In these few isolated spots have been developed the *Dolly Varden*, *Granby* mines, *Premier*, and *Engineer* mines. If these partially prospected areas are any criterion, some idea of the immense potentialities of the balance of the belt may be had. It is the future great mineral-producing zone of the Province.

Everything possible should be done by the Government in the way of opening up navigation and building roads and trails, to keep reconnaissance, prospecting, and development well in advance of the producing areas. To this end a mining-trail should be started from Stewart, the farthest north seaport in the Province, and extended over the Bear River divide to the eastern slope of the Coast range. The slope then followed north to a point on the Stikine river, a straight distance of about 125 miles, keeping as close to the contact mineral-belt as is consistent with the building of a good-grade trail that can eventually be converted into a wagon-road. South of the Bear River pass shorter sections of trail could be built to connect accessible spots; as from the Bear River pass to the Kitsault river and Alice Arm, about 35 miles of trail; from Alice Arm by way of the Illiance river to the Nass river, about 20 miles of new trail; and from the Nass River to Terrace, on the Canadian National Railways, repairing of the present trail of about 70 miles. Altogether this would open up another 125 miles along this belt.

East of the Eastern Contact Belt the whole northern end of the Province, comprising an area of over 90,000 square miles in this district alone, is an unexplored empire in itself. The only route into this area is up the Stikine river to Telegraph Creek and from there by trail

to Dease lake, from which point are waterways. All that is known of it is that several millions of dollars were taken out in placer gold in the vicinity of Dease lake forty years ago. It is an ideal field for exploration, with hydroplanes as the means of transportation, on account of the ideal landings provided in the innumerable lakes that dot the whole country. Two weeks' reconnaissance-work from such a point as Hazelton, the most northerly point on the Canadian National Railways, would map the country sufficiently to select routes of travel and stations. A radius of 300 miles would reach any part of the country. Prospecting parties with supplies could be put down at any desired point, and the extent of exploration would only be limited by the number of parties. By this means more of the northern interior country could be prospected in one or two seasons and more information gained than has been to date, or could be in the next twenty years by present methods.

Though developments are proving that the formations of the Eastern Contact Belt are particularly favourable for the occurrence of the economic minerals, the Coast range and the Western Belt, with their unsurpassed transportation facilities, should not be passed up by the prospector and operator. A low-grade ore that would not pay transportation charges from the interior might make a mine on tide-water. The granite-belt is, as yet, the greatest mineral-producer in the district, from the two mines, the *Belmont-Surf Inlet* at Surf inlet and the *Granby* at Anyox.

There has been a notable increase in the amount of prospecting and exploratory work done in this belt in the past two years, and there are several properties that give good reasons to believe that they will, with development, make shippers.

The Western Belt includes all the Coast islands west of the granite and the Queen Charlotte group. This zone is receiving more attention than heretofore, and a number of showings on the smaller, inshore islands, as well as on the Queen Charlottes, are showing up well with the work being done on them by the owners. Should the steel industry amount to anything on the Pacific coast, the big magnetite and magnetite-chalcopyrite deposits in this belt would no doubt come into prominence.

The Summary Report, 1920, Part A, published this year by the Department of Mines of Canada, contains a preliminary report of S. J. Schofield and George Hansen on the geology and ore occurrences of the Salmon River section. This report, together with the geological map, which has later been issued, gives opportune information to the prospector and mining operator. The detail report will be published early in the year. George Hansen this year completed the Geological Survey work in the Kitsault River section, and the publication of his report and map will be sincerely appreciated by those interested in the development of that area.

The Mining Situation.

The general financial and metal market depression during the year has, of course, not slighted the mining industry of the Province, but the effect on this northern portion of the Province has been surprisingly slight. About the only difference to be noted, in so far as mining is concerned, is that there has been probably less capital with which to take hold of new properties, and also that some of the smaller operators have had to suspend operations and relinquish their options. The latter has not in any way reflected against the merit of the property, for in nearly every case the owners have gone ahead with the development of the property themselves.

Last year's important shippers, with the exception of the *Dolly Varden* at Alice Arm, have been continuously operated and have shipped throughout the year. Very fortunately for the mining industry of this North Coast country, the Granby Consolidated Mining, Smelting, and Power Company has been able to maintain production all year. Though it is estimated that it will take about another year, under present industrial conditions, to absorb the excess reserves of copper, it is expected and hoped that such a calamity as the closing of the Granby plant will be averted. The production of the Premier Gold Mining Company, Limited, of Stewart, of over $1,500,000 this year is indicative of the output that is to be expected from that property in the future. At the *Belmont-Surf Inlet* mine, on Princess Royal island, the completion of a tramway from the *Pugsley* mine, where large ore reserves have been developed, to the concentrator will ensure the production of the property for some time to come. The production of the *Dolly Varden* mine at Alice Arm, under operation for the last two years by the Taylor Engineering Company, has been a disappointment this year and has had a somewhat depressing

effect on that mining section. Little or no development has been done and the tonnage shipped was ore that had been broken down the previous year. The policy of capacity extraction to the exclusion of development-work during the high price of silver was probably a commendable one, but apparently no provision was made for financing development-work when the higher-grade ore was exhausted. Litigation over the *Engineer* mine, on Tagish lake, Atlin, has unfortunately not yet reached the highest Court. The *Maid of Erin* property, in the Rainy Hollow section of the Atlin Mining Division, is developing very satisfactorily and has every appearance of becoming an important shipper of high-grade copper ore as soon as hauling facilities from the mine to tide-water at Haines are provided. There are several other properties throughout the district that are gradually being developed beyond the prospect stage and give reason to believe that they will make shippers. The placers of Atlin, Stikine, and Liard Mining Divisions have made about the same production as last year. Though Ruby and Otter creeks, in the Atlin country, did exceptionally well this year, it is not expected that the present output will ever be very greatly exceeded unless new diggings are struck. In the Liard Division the Dease Lake diggings produced only about $5,000 all told, but with better conditions in sight for next season a greater clean-up is looked for.

A great deal of prospecting has been done in all sections of the district, with results that are surprising the old-timers themselves. It looks, in fact, as if the older mining sections were just beginning to be seriously prospected, with results proportionate to the thoroughness of the work. If some provision to the "Mineral Act" could be devised, eliminating the "claim hog," who is always a "restaker," because it is impossible for him to perform the legal assessments on his many claims, it would compel a great deal more assessment-work, which is the one vital necessity to a mining district; prove a great incentive to the prospector in every way; and remove a very serious handicap to mining progress.

There has been an epidemic of oil-land staking (no rock formation barred) and about 350 locations have been made, principally in the Kitsumgallum and Lakelse valleys, Nass River valley, and Queen Charlotte islands. It is hoped that some one will have the courage of his convictions and do some serious prospecting in the shape of drilling.

A very appreciable amount of assistance was granted by the Department of Mines, under the "Mines Development Act," to prospectors and operators throughout the district for trail-work. In several cases, where widespread damage was done by floods, this assistance was very opportune.

Summarizing the mining situation from a development standpoint, there is an apparent feeling of optimism in all parts of the district, from the prospector up to the producer, and with the brighter outlook of general industrial conditions and consequently more money for mining undertakings, together with reduced costs of labour and supplies, I look for an appreciable increase in exploratory and development work throughout the district the coming year.

The following is a list of the shipping properties in District No. 1 and their outputs for 1921:—

PRODUCTION FOR 1921 FROM DISTRICT NO. 1.

Name of Property.	Location.	Ore mined.	Gold.	Silver.	Copper.
		Tons.	Oz.	Oz.	Lb.
Maid of Erin		55	3	1,808	25,664
Granby Consolidated Mining, Smelting, and Power Co., Ltd.	Anyox	896,802	7,652	314,204	34,067,185
Golskeish Mines, Ltd.	Anyox	9,203	943	3,518	.....
Taylor Engineering Co., Ltd. (Dolly Varden)	Alice arm	1,874	.....	45,648	.....
Premier Gold Mining Co., Ltd.	Stewart	18,750	40,104	1,177,978	.....
Drum Lummon Mines, Ltd.	Drum Lummon bay	4	7	75	4,286
Belmont-Surf Inlet Mines, Ltd	Surf inlet	134,570	36,476	20,706	744,632
North Star		85	.....	1,870	.....
Totals for 1921 (exclusive of placer)		1,061,343	85,185	1,565,807	34,841,767
Totals for 1920 (exclusive of placer)		979,993	56,246	1,375,726	26,153,403
Increase		81,350	28,939	190,081	8,688,364
Decrease		.....	.....	.....	.....

The above list, showing the mineral production of the district for the past year, proves the mining industry to be in a very satisfactory and healthy condition. Not only has the tonnage

mined and the quantity yield of gold, silver, and copper exceeded that of last year, but they have the additional distinction of being the greatest of any year in the history of the Cassiar District. The tonnage mined has gone over the 1,000,000-ton mark and shows an increase of about 9 per cent. over last year. Gold has made the sensational gain of about 60 per cent., amounting to approximately $633,500 over the output of 1920. Silver shows a slight increase in ounces of output, but depreciated $385,000 in value, due to the drop in the average yearly price of 100.9 cents an ounce for 1920 to 62.65 cents an ounce for 1921. Copper also made an increase of nearly 9,000,000 lb., or about 34 per cent. greater than last year, but decreased $208,000 in value on account of the average yearly price dropping from 17.46 cents for 1920 to 12.5 cents a pound for 1921. The gain of $633,500 in gold, however, offsets the depreciation in silver and copper, totalling $593,000, leaving a gain in values of about $40,500 over the output of 1920.

The great increase in gold is due to the wonderful production of the Premier Gold Mining Company, of Stewart, amounting to 40,104 oz., against 2,283 oz. last year. The Belmont-Surf Inlet Mines, Limited, show 36,476 oz., a decrease of about 7,500 oz. from the previous year. Granby fell off a little in gold on account of the quartz mined for flux carrying no values. Last year the gold from this source was 1,715 oz.

It will be noted that the total silver-output was over 1,500,000 oz., of which the Premier Gold Mining Company alone produced over 1,000,000 oz. In 1920 the *Dolly Varden*, of Alice Arm, was the star silver-producer of over 831,000 oz., which apparently was insufficient to maintain operations. *Belmont-Surf Inlet* just about equalled last year's silver yield.

Copper has had a very material increase over last year, due solely to the increased production of nearly 9,000,000 lb. by the Granby Consolidated at Anyox. The *Belmont-Surf Inlet* shows a small increase in copper. The Maid of Erin Silver Mining Company, operating the *Maid of Erin* mine in Rainy Hollow, was able to get out 55 tons of ore before the winter set in. The ore averages about 25 per cent. copper.

Altogether, the district produced 67 per cent. of the total tonnage mined in the Province, yielding 62 per cent. of the total gold, 58 per cent. of the total silver, and 89 per cent. of the total copper, and is the only district in which the value production equals that of last year.

This record, notwithstanding the general industrial depression, is a strong comment on the soundness of the growth of the mining industry in the north-western part of the Province. Previously in this report the mining situation was sized up from the standpoint of prospecting and development, and now, judging it from the standpoint of production, one's predictions must be optimistic.

The Granby Company may be expected to maintain its average yearly output. The Premier Gold Mining Company, with its concentrator and tramway completed and in operation, and its known ore-bodies hardly touched as yet, will no doubt greatly increase its output in the next year or two. The *Belmont-Surf Inlet*, with new tramway facilities for handling the *Pugsley* mine ore to the concentrator, and the opening-up of the ore-bodies on the 1,000-foot level of the old mine, is in a position to maintain its present output and probably increase it next year. As stated before, the *Maid of Erin* mine is developing very satisfactorily and looks very much like an important producer of high-grade copper ore when transportation is provided.

The *Dolly Varden* will in all likelihood be put on a producing basis again. The *Engineer* mine in Atlin, if it ever gets through all the Courts and free of litigation, should develop into an important gold-producer very quickly. The *Silverado* property at Stewart is now mining from a small high-grade vein and there are other large veins on the property that give it great possibilities.

Besides the above shipping mines, there are a number of smaller properties throughout the district, in the Kitsumgallum Lake section, and in the Alice Arm and Stewart districts that are expected to be producing in a small way within the next year.

The district will be reviewed under the main headings of the Mining Divisions, subdivided into sections as follows:—

Queen Charlotte Mining Division—Graham Island section; Moresby Island section.

Bella Coola Mining Division.

Skeena Mining Division—Coast section; Canadian National Railway section; Kitsumgallum Valley section; Lakelse Valley (Thornhill Mountain) section.

Nass River Mining Division—Observatory Inlet section; Hastings Arm section; Alice Arm (proper) section; Kitsault River section; Illiance River section.

Portland Canal Mining Division—Portland Canal (proper) section; Marmot River section; Bear River section; Meziadin Lake section; Salmon River section; Unuk River section.

Stikine Mining Division—Stikine River section; Iskut River section.

Liard Mining Division—Dease Lake section.

Atlin Mining Division—Rainy Hollow section; Atlin Lake section.

QUEEN CHARLOTTE MINING DIVISION.

The mining situation on the islands has not changed very materially since last year's report. About the only work being done is by the owners on their own holdings.

Graham Island Section.

In the early part of the summer it looked as if something were going to be done toward developing the oil-shale industry on the western slope of this island. A large area of ground had been acquired and considerable prospecting and exploratory work done in defining the oil-shale belt and obtaining a fairly accurate estimate of the probable tonnage, which was said to be entirely satisfactory. Many field tests were made of the shale and large samples procured and shipped for exhaustive experiments. It was reported by Nick Clark, one of the principals in the undertaking, that the shales from the surface averaged about 10 gallons to the ton and that the oil content improved as more depth was attained, and also that a satisfactory process for the extraction and refining of the oil on the ground had been worked out. Shales with anything over 25 gallons to the ton could be worked at a profit, and to this end successful experiments had been made along the lines of concentration of the shales before retorting for the elimination of the less oil-saturated particles of silica. This concentration was about 4 or 5 into 1 and the concentrated shale ran well over 30 gallons to the ton.

Analyses of the shale-oil were given as: Gasolene, 15 per cent.; kerosene, 14 per cent.; gas oil or distillate, 18 per cent.; light lubricating-oil, 17 per cent.; heavy lubricating-oil, 28 per cent.; residue, 8 per cent.

Their holdings have been kept in good standing, but nothing further has been done in connection with the shales. The principals have probably gone to the Mackenzie basin.

The black, gold-bearing beach sands on the north and east coasts of Graham Island is another hardy annual. A number of leases have been taken up for next spring's operations.

South Easter Group.—(*See* report of 1918, page 37.) Nothing of any note has been done on the property this year.

Moresby Island Section.

The west coast of Moresby, around Gold and Kootenay harbours, has had considerable prospecting during the past year or two and a number of small free-gold quartz veins characteristic of that area have been found.

Early Bird Group. The reader is referred to the 1918 report, page 41, for a description of this property. It is owned by J. G. McLellan, of Queen Charlotte City, and situated on Gold harbour. Nothing has been done by the owner on the property for some years, but I understand that it is now under lease to Davey & Pearsen, who are getting fair returns for their work.

Blue Mule Group. This group was reported on last year, 1920, since which time the owners, Jones, Wiggs & McRae, have done further work and, I am informed, have opened up some very promising showings of free-gold ore. I regret that I have been unable to get to the property this year. It is reported that one of the owners, J. H. Jones, and Nels Larsen have taken a lease on the property for three years and are now engaged in development-work.

Homestake Group. This is an old property on the north side of Cumshewa inlet, on which considerable work was done several years ago, and from which some small shipments of rich, very closely hand-sorted ore was shipped. It was reported on in 1913 Minister of Mines' Report by D. G. Forbes, who says in part that there are two ledges, a north and south one, lying in a shattered zone of slate, between slate and siliceous limestone formations. The gangue is quartz and calcite and the mineralization pyrite, zinc-

blende, and a little galena. A drift was run on the north vein for 239 feet and on the south vein for 435 feet, with crosscuts, winzes, etc., totalling over 2,000 feet of work. The general tenure of the ore is low except where galena is found, when the values go up as high as $100 to the ton in gold. It is reported that this property will resume operations at an early date.

Iron Duke Group. This group is situated on Louise island and is a very promising-looking magnetite-iron property, judging from surface indications. The claims have been surveyed this summer and applications made for certificates of improvements for Crown grants. The reader is referred to the Minister of Mines' Report, 1918, for more detailed information.

Swede Group. This group of eight claims, owned by Rogers, Pearsen & Larsen, lies just to the left of the entrance to Lockeport harbour, on the east coast of Moresby island. The claims contain an immense deposit of low-grade copper ore consisting of chalcopyrite and bornite, disseminated and in small bunches and veinlets throughout a diabase country-rock. Two tunnels have been driven, one 170 feet and another, farther north, 80 feet. They both show disseminated chalcopyrite, but the latter has also a small percentage of bornite scattered through it. The bornite carries a little platinum in the best of it, a sample assaying 3.1 per cent. copper, showing 0.01 oz. platinum and a trace of palladium, 20 cents in gold, and 1 oz. silver to the ton. The owners are only keeping up assessment requirements. The property is ideally located for working on any scale.

Ellen Group. This group is situated on Shuttle island, about 7 miles south of Lockeport. There are four claims in the group—*Ellen*, *Georgia Mac.*, *Bald Eagle Frac.*, and *Acroplane*—owned by Edwards and partner. The group was bonded early in the year to Archie McVittie, of Victoria, who was to have installed a small mill of the Ross type. However, nothing much seems to have been done.

The owners had been working pretty steadily on the property and did considerable work, mainly on the *Ellen* claim. It consists of a crosscut tunnel 100 feet long, following a small quartz stringer to its junction with the main quartz vein, gaining a depth of 25 or 30 feet in that distance. The main vein was then drifted on for 25 feet and a shaft sunk to a depth of 26 feet at the intersection of the veins. This work discloses a brecciated quartz-slate vein-filling, averaging about a foot in width, in a slaty country-rock. Free gold occurs in the vein, some in the quartz, but mainly around and in the inclusions of country-rock. Some fine specimens have been obtained, but the values are very spotted and the general average, I judge, would be low.

Tickscy Placer Claim.—This claim, on the beach on Shuttle island, is being worked by the three owners. They are installing a small pumping plant to supply a head of water for sluicing. The extent of gravel is pretty small to be of great importance.

Copper Island.—The owner of the claims on this island, just outside Jedway harbour, Mr. Heino, has been working on these and his iron claims on Burnaby island all summer. I regret that I have been unable to get over this fall and also that I have no information as to the outcome of his season's work.

Burnaby Island.—Campbell & Wildes have done some work on their claims, the *Bank of Commerce* and *Mother Lode*, with, it is reported, very good results.

Ikeda Mines, Ltd.—Operations have not been resumed since closing down last year.

Thunder Group.—This group is owned by Ike Thompson, of Jedway, and situated on Collison bay. It was optioned this spring to Seattle interests, but as yet nothing has been done on the property.

BELLA COOLA MINING DIVISION.

I have been unable, owing to lack of time, to get over this Division this year and consequently can only report from office statistics that the yearly assessments have been kept up. Last year gave some hope that an iron ore (magnetite) industry might be developed, but none has been mined or shipped this year.

SKEENA MINING DIVISION.

This Division takes in about 200 miles in length of the Coast range; the coast-line and islands to the mouth of Portland inlet; and also includes a small portion of the Eastern Contact Belt, from Lakelse lake north to the southern boundary of the Nass River Mining Division.

The Coast granites are made easily accessible by hundreds of miles of canals and inlets, notably Douglas channel, Gardner canal, and Kitimat arm. The interior is reached by the

Canadian National Railway, from which access is had to the Lakelse and Kitsumgallum valleys from Terrace. A great deal of prospecting has been done along the Coast and on the islands, and the Kitsumgallum Valley section has been quite active, especially in the vicinity of Kitsumgallum lake. The latter does not refer to the oil-land staking, but to mining. There is at present only one shipping property in this Division, the *Belmont-Surf Inlet* on Princess Royal island.

Coast Section.

This includes all the Coast islands and any part of the Mainland on tide-water, and is one of the least expensive and most accessible portions of the Province for prospecting.

Belmont-Surf Inlet Mines, Ltd.

The mining property of this company is situated at the head of Surf inlet, on the west coast of Princess Royal island. The company, which is subsidiary to the Tonopah-Belmont Development Company, has been shipping from this property since 1917. During that time up to the end of 1921 about 500,000 tons of ore has been mined and milled, yielding approximately 175,000 oz. gold, 100,000 oz. silver, and 2,700,000 lb. copper.

This year has been the biggest yet in point of tonnage mined and milled, amounting to about 135,000 tons, or an average of nearly 400 tons a day treated in the concentrator. This tonnage of mine-run ore produced 11,483 tons of flotation concentrates shipped to Tacoma and yielding 36,476 oz. gold, 20,706 oz. silver, and 744,632 lb. copper, a small increase in silver and copper over last year, but a decrease of about 8,000 oz. gold.

The year's work consisted mainly of stoping from the upper levels, the sinking of a winze from the 900-foot to the 1,000-foot level, and driving laterals on the lower level. The total footage of drifting and crosscutting for the year was about 5,000 feet and the winze and raises about 2,600 feet. The number of men employed would average about 200 throughout the year.

The main working-shaft from the 550-foot level, the main haulage level of the mine, will now be sunk from the 900-foot to the 1,000-foot level and in all probability will be continued another level. The vein and ore on the lowest level are reported as being very satisfactory.

A 2-bucket, high-speed, reversible tram has been installed this summer from the lower tunnel of the *Pugsley* mine, owned by the company, to the crusher-bin at the mine, from which the ore is carried by travelling-belt to the concentrator. The tram is a single span of 2,300 feet, of 1⅜-inch smooth-coil track-cable and ½-inch traction-cable operated by a 25-horse-power motor geared to an 8-foot bull-wheel. Its capacity is about 12 tons an hour and hoists to an elevation of about 400 feet above the lower terminal. The tram was put in operation about the middle of September.

At the *Pugsley* mine a raise has been put through from the lower to the upper tunnel, a distance of 245 feet, and several stopes are now being opened up on the lower levels preparatory to supplying ore to the concentrator.

F. H. Penn, former mill superintendent, is now general superintendent at the mine, succeeding F. W. Holler, resigned. E. W. Hawkins is auditor and Cliff Seale, mine superintendent.

Cordila Group.

This group consisting of six claims—*Mountain View*, *Royal*, *Landslide*, *Bight*, *Counder*, and *Present*—staked in July, 1920, by Corila & Koski, is situated on the north end of Princess Royal island just back of Rivers bight. A working bond was taken on the property this fall and work started by the Rivers Bight Syndicate. I did not have an opportunity of seeing the property this fall, but it is reported that the work is progressing well and the showing much the same as the *Surf Inlet* mine.

Payroll Group.

This group consists of two claims on Kiltuish or Long inlet, owned by Jas. Hickey and partner, of Prince Rupert. Assessment-work was done on the claims this summer by the owners, who report the vein to be exposed for a width of 20 feet. It is quartz in a country-rock of hornblende-schist, mineralized with pyrrhotite and a little chalcopyrite scattered through it. Gold values are spotted, varying from a trace to $14 to the ton. The showing is right on the beach and the ore could therefore be mined and shipped at minimum cost.

Stewart Group.

This group is situated on the Kemano river, about 6 miles up from Gardner canal. The property has hitherto been rather inaccessible, except at certain stages of the water in the river, when poling and lining could be used. A trail was cut this summer from the mouth of the river up the west side to a point opposite the creek up which the claims lie. The showings have been described as a mineralized dyke 200 feet

Alder Island—Open-cut on Gatt's Claim.

Alder Island—Dyke on Gatt's Claim.

wide lying in the granodiorite of the Coast range. Gold, silver, and copper values are found throughout the dyke, but there are small veins of ore in places of better grade.

The property is owned by M. M. Stephens and Captain Babbington, of Prince Rupert. Mr. Stephens brought in some samples this fall from the property of very promising-looking quartz mineralized with bornite and chalcopyrite and carrying gold and silver values.

Douglas Channel Mines.

(Formerly Drum Lummon Mines, Limited (Non-personal Liability).) This company was incorporated in June of this year, with a capitalization of $3,000,000, divided into 3,000,000 shares, with its head office in the Credit Foncier Building., Vancouver. The old company, the Drum Lummon Mines, Limited, deeded thirteen Crown-granted mineral claims, including the *Drum Lummon* mine, to the new company, retaining two mineral claims and obtaining a considerable portion of the stock of the new company. The old name was changed to the Douglas Channel Mines.

The new company's holdings are being developed by contract with the Glenville A. Collins, Engineers, Limited, of Vancouver. Under this new management a great deal of work has been done this summer, including the dismantling of the old mill, the erection of a larger camp and a snow-shed at the mouth of the tunnel, moving of the compressor to housing at the mouth of the tunnel, and the sinking of a winze on the vein on an angle of 45° to a depth of 100 feet. This winze-sinking is now being pushed as rapidly as possible, and when the desired depth is attained another level will be driven to the west on the vein. It is also intended to continue the present level another 100 feet on the vein and complete the raise through from this level to the surface for ventilation.

A favourable smelting rate has been procured from Granby Consolidated and it is contemplated shipping the siliceous mine-run ore to the Anyox plant. About 5 tons of ore was shipped to Granby this summer, assaying 50.6 per cent. copper, 17.7 oz. silver, and 1.67 oz. gold to the ton.

Mr. Collins, manager, informs me that the work is progressing satisfactorily and that, everything considered, the property is looking very promising.

Canadian National Railways Section.

This section includes all the country contiguous to the railroad, from Prince Rupert to Terrace, a distance of 93 miles, and is practically all in the granite Coast range. There has been little real prospecting done along the railroad, though in the early boat-days up the Skeena river many claims were staked along the river. Little or no prospecting has been done away from the railroad or river, but a little more interest is being taken each year.

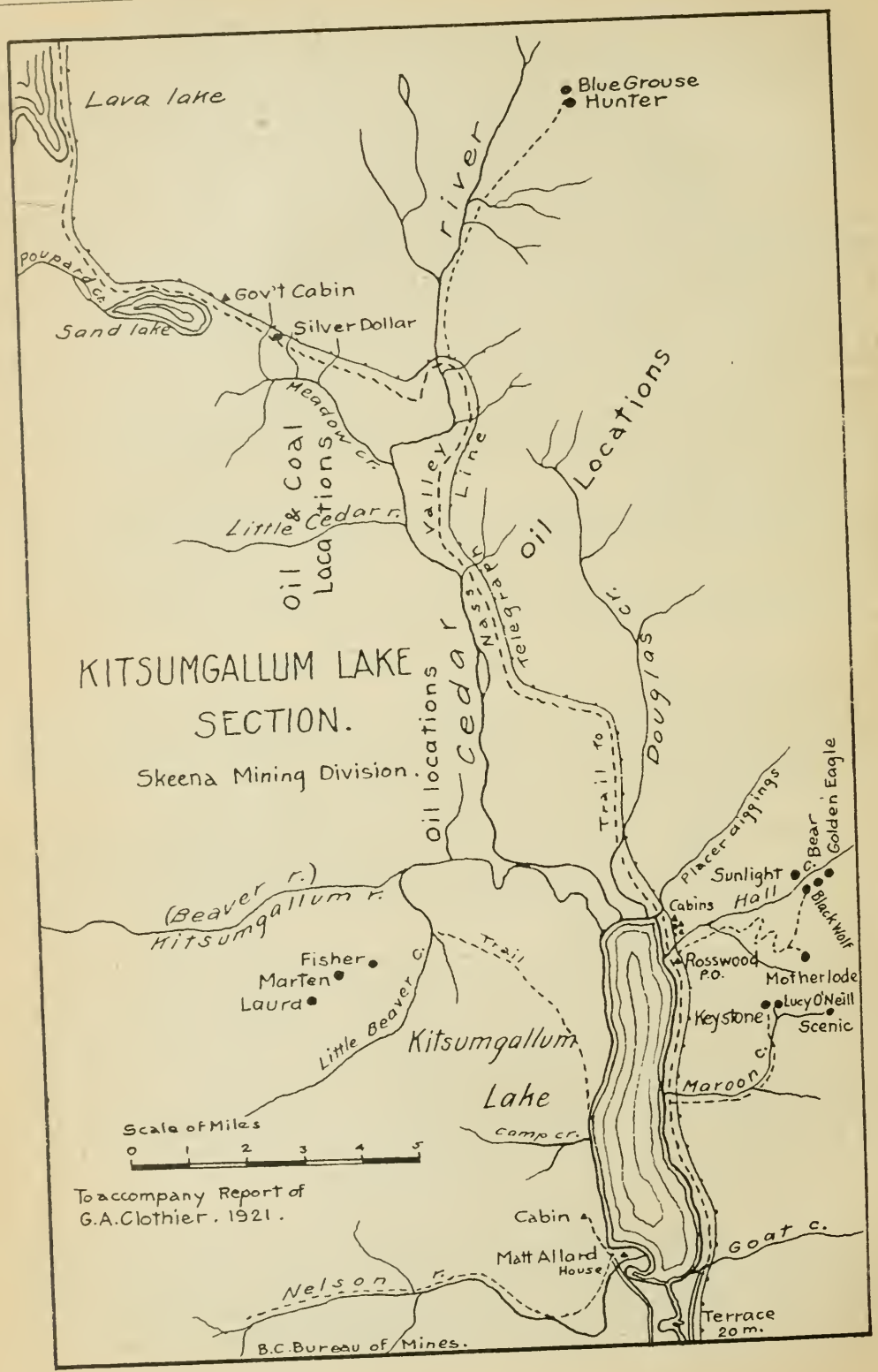
Graphite Group.

This is a group of claims lying on the south side of the Skeena river, about opposite the station of Salvus, 60 miles from Prince Rupert. They were staked and are owned by Doc Stanwood and Phil Chesley. I was over the ground this fall and found that owing to the heavy overburden and the consequent few exposures of the rock formations, it was extremely difficult to "size it up" and arrive at any conclusions as to the possibilities of the property.

Graphite is found in a belt of more or less metamorphosed granite, probably 1,000 feet in width and several miles long. There seems to have been a profound movement in this belt or zone, splitting it up in all directions and forming bands, of considerable widths, of gneissoid granite. Along the seams in the granite and in the gneiss bands there has been considerable alteration and decomposition of the granite. The graphite occurs in minute flakes mainly along the fracture-faces, but possibly disseminated throughout the altered granite. It would require a thorough examination of the property and probably extensive exploratory work to determine whether the graphite content is sufficient for commercial ore. The owners claim an assay of 3 per cent. graphite across a width of 400 feet about the centre of the zone, and also to have obtained gold values of $1.75 to the ton from different places.

Kitsumgallum Valley Section.

There was considerable activity in this section this year, both in prospecting and development-work. Two or three parties were prospecting on Maroon mountain and others at the head of Douglas creek. A party of four also made a three-weeks' trip up the Beaver river from the head of Kitsumgallum lake. They report that the South fork of Beaver is all in granite, but that there is a good-looking country for prospecting all along the North fork.


Lava lake
Blue Grouse
Hunter
river
Skeena
Poupard Cr.
Gov't Cabin
Silver Dollar
Sand lake
Meadow cr.
Sloppy cr.
Oil & Coal Locations
Valley Line
Little Cedar r.
Oil Locations
Nass
Telegraph
Cedar r.
Douglas cr.
KITSUMGALLUM LAKE
SECTION.
Skeena Mining Division.
Oil locations
Trail to
Placer diggings
Golden Eagle
Bear cr.
Sunlight
Cabins
Hall
Black Wolf
(Beaver r.)
Kitsumgallum r.
Fisher
Marten
Laura
Little Beaver cr.
Trail
Rosswood P.O.
Motherlode
Lucy O'Neill
Keystone
Scenic
Kitsumgallum
Lake
Maroon cr.
Scale of Miles
0 1 2 3 4 5
Camp cr.
To accompany Report of
G.A. Clothier. 1921.
Cabin
Matt Allard
House
Goat cr.
Nelson r.
Terrace
20 m.
B.C. Bureau of Mines.

This section lies along the Eastern Contact Belt and is a worth-while accessible country to prospect, from Terrace to the Nass River, a distance of about 70 miles. This summer I walked through on the Telegraph trail and took a pack-horse from the head of the lake to Ayansh, on the Nass river, about 40 miles, and found the trail badly in need of repairs, rebuilding, and clearing out for several stretches. No time could be taken for any reconnaissance off the trail. The rock formation is, apparently, predominantly metamorphosed sedimentaries, with numerous granite dykes and spurs and other igneous intrusions. I should judge it a very favourable belt for mineralization.

Recommendations have been made to the Geological Survey of Canada for as detailed reconnaissance as possible of the area around Kitsumgallum lake and through to the Nass river.

A considerable area north of the lake has been covered with oil locations by the Kitsumgallum Basin Petroleum Company, Limited, with its head office at Terrace. From the south end of the lake to Terrace and the Lakelse valley has been blanketed by other parties for a distance of 20 miles. The prospectus of the Petroleum Company and the statements of those interested in the other locations leave nothing to be doubted as to the existence of oil in commercial quantities, but drilling would be a good idea. The proximity to the Coast Range granites is probably not a promising feature.

Motherlode Group.

There are three claims in this group—the *Motherlode*, *New York*, and *B C.*—owned by Oscar Gendron, Jack Couture, Oscar Olander, and Paul Brodine, of Terrace. The claims are situated at the head of the South fork of Falls creek, about 5 miles by trail from the head of Kitsumgallum lake. There is a good horse-trail built by the owners through to the *Bear* group, a branch trail from it going to the *Motherlode* cabin, which is at an elevation of 5,200 feet.

The owners claim that there is a mineralization above the bluffs cropping for a width of from 30 to 50 feet, and this is evidenced by the quantity of float found in the slide at the foot of the bluff. They started a tunnel at 5,600 feet elevation last year and drove it 30 feet, cutting a little ore at the mouth of the tunnel. The balance of the tunnel is in an andesitic dyke, which intrudes and is interbedded with the altered sedimentaries, which is the predominating country-rock. This tunnel was abandoned and another started 200 feet vertically lower, with the idea of cutting the ore which shows in the mouth of the tunnel above. This lower tunnel had at the time of my examination (August 14th) been driven 15 feet into the slide-rock, which, fortunately, is cemented with ice and good driving. Since there is plenty of ore float above the upper tunnel, I advised the continuation of that tunnel through the andesitic dyke. I have no information as to later development.

The float found is a schistose rock in which are bands of quartz mineralized with zinc-blende, galena, chalcopyrite, a little grey-copper, and an occasional flake of native silver. I think there is a good chance of opening up a body of milling-grade ore.

Black Wolf and Golden Eagle.

These groups of two claims each were located this spring by the owners of the *Motherlode* group on the extension of the *Bear* vein. The *Black Wolf* is on the south and the *Golden Eagle* on the north end of the *Bear* group. The vein has been traced on the surface through both groups, the northerly extension striking across the head of Falls creek into Goat mountain. The vein is small, from 8 to 12 inches wide, and lies in a schistose country-rock, conforming with its strike and dip. It consists of quartz more or less mineralized with galena, zinc-blende, and pyrite, but in places is composed entirely of sulphides. Gold can be panned anywhere along the vein, the decomposed and honeycombed quartz being especially rich. A sample of about 10 lb. was taken from different parts of the vein, of average vein material, ground up in a mortar and panned. The concentrates after amalgamation assayed $192 in gold and 12.2 oz. in silver to the ton and 22 per cent. lead. The tailings assayed $6 in gold, 2.6 oz. silver, 4 per cent. lead, and 70 per cent. insoluble.

Seattle interests, represented by Mr. Hore, have taken a lease and bond on these two groups and, I understand, expect to have a small mill in operation early next spring.

Bear Group.

This group is situated at the head of the North fork of Falls creek and north of the *Motherlode* group. There are four claims in the group—*Bear*, *Hawk*, *Whistler*, and *Goat*—owned by Matt Allard, of Terrace, and associates. There is a good pack-horse trail from the head of the lake to the workings.

The prevailing country-rock is a schistose slaty rock, striking N. 10° E. (mag.) and dipping easterly. The work has all been done on the *Bear* claim and consists of a number of open-cuts and trenches, exposing for a length of 700 to 800 feet a bedded quartz vein, up to 4 feet in width, mineralized with galena, zinc-blende, and pyrites. A shaft has been sunk 12 feet from the bottom of an open-cut, showing a face up and down on the vein of 20 feet, exposing about a foot of solid ore, mainly galena. Free gold can be panned all along the vein. A sample of a small seam of honeycombed quartz assayed 111.2 oz. gold to the ton. This little vein is very consistent through three groups of claims.

Mr. Hore, representing Seattle interests, has taken a lease and bond on this property in connection with the *Black Wolf* and *Golden Eagle* groups, which lie on either side of the *Bear* group. He intends putting a small mill on Falls creek as early as possible next spring (1922) as an experiment.

Lucy O'Neill. This claim is owned by George Little, of Terrace, and associates. It is situated about 8 miles up Maroon creek, which empties into the east side of Kitsumgallum lake about 3 miles from the head. The owners, with assistance from the Department of Mines, have built a good trail from the lake up Maroon creek to within a mile of the camp and have put a good cabin at an elevation of 2,225 feet, or about 1,800 feet above the lake. The trail could be improved into a pack-horse trail with very little additional expense, but to be of use as such the trail from the foot of the lake to Maroon creek would have to be repaired into a pack-horse trail as well. A pack-horse could then be taken through from Terrace to the head of Maroon creek, where there is a good-looking mineral area.

The work done on the claim consists of a shaft sunk 15 feet on a quartz vein lying in massive granite formation, probably a spur from the granite-mass which shows around the foot of the lake. The fissure-filling shows 18 inches of altered and slightly mineralized granite on the footwall; then 3 feet of heavily pyritized quartz carrying a fair percentage of chalcopyrite; then 2 feet of diorite dyke; and about a foot of mineralized quartz on the hanging-wall. The vein strikes N. 70° E. (mag.) and dips 60° to the north-west. No work has been done on the surface toward tracing or opening up the vein. The owners claim to have had assays up to $30 to the ton in gold, silver, and copper values. The ore would have a concentrating ratio of 6 or 8 into 1 and should make a good shipping product. The vein is well defined, well mineralized, and worth considerable exploratory-work.

Keystone.—This claim is owned by J. E. Garland, of Terrace, and adjoins the *Lucy O'Neill* claim on the west. The owner was starting an open-cut across the creek from the *Lucy O'Neill* shaft on the same vein.

Scenic.—This claim, also owned by J. E. Garland, is situated about 2 miles farther up the North fork of Maroon creek. I did not get up to this, but the owner informed me that he had discovered a 10-foot vein of quartz in diorite country-rock that resembles the vein and mineralization on the *Lucy O'Neill* and *Keystone* claims.

Fisher.—This claim has been held by Matt Allard for several years and this year he sold it to Mr. Hore of Seattle, who has working agreements on three other groups as well. The *Fisher* claim is situated about 5 miles from the lake, up the Little Beaver river, a tributary of the Kitsumgallum river. Mr. Hore took in a small mill of the Ross type, I believe, and got it on the ground, but did not get it installed. Work will be resumed in the spring.

The *Marten* group is owned by W. Treston and partner and is also on the Little Beaver river.

With assistance from the Department of Mines, a trail was cut from the lake to the canyon on the Little Beaver river, a distance of about 4 miles. This will enable prospectors to get to their claims in that vicinity, and should be continued up the Beaver river to open up that section, which is claimed to be a very likely one.

Silver Dollar Group. This group consists of two claims—the *Silver Dollar*, owned by Oscar Gendron and J. Couture, and *Silver Coin*, owned by J. Belway and the Estate of A. McLaren. The claims are situated on the Telegraph trail, about 3 miles west of Cedar River Crossing. This was formerly the *Iona* group of four claims, described by W. M. Brewer in the Minister of Mines' Report, 1914, page 109. Considerable work had been done by the former owner, mainly two long open-cuts along the vein and a crosscut tunnel about 40 feet long, driven to pick up the vein under the east open-cut. This shows the vein at that level to be from 12 to 15 feet wide, of a broken-up, brecciated quartz

and slate country-rock, very slightly mineralized with pyrites and an occasional speck of galena. The open-cut above the tunnel shows about the same.

Recent work has apparently been done on the west open-cut for this has opened up the vein along the foot-wall for a length of 30 feet. Two or three small lenses of high-grade ore, consisting of steel galena, some antimony, grey-copper, and a little zinc, carrying silver values up to 250 or 300 oz. to the ton, are exposed in this length. These lenses are too small and uncertain to be of much importance. There is about a ton of sorted ore on the dump.

Assessments were done on the *Blue Grouse* and *Hunter* groups, about 5 miles up the Cedar river from the crossing, by the owners, Oscar Olander and O. Wickstrom. Several individual claims were also represented. There is a good foot-trail from the crossing up the east side of Cedar river, built by Olander with aid from the Department of Mines.

Lakelse Valley (Thornhill Mountain) Section.

I did not get over this section this year owing to lack of time. However, it was reported on in 1918.

Lucky Seven Group.—This group of claims belongs to the Estate of Andrew Olson. They were bonded this spring to J. Ronan, who did considerable work on the small gold vein on the *Diamond* claim, where Olson and partner took out some small pockets of free gold. Development-work, however, did not justify taking over the property.

The *Iron Hat* claim was included in the above bond. The tunnel was driven ahead on the vein about 20 feet, which did not improve sufficiently to warrant further work.

Yearly assessments were done on the two principal groups on Thornhill mountain—the *Ptarmigan* group, owned by Michaud Bros., of Terrace, and *Society Girl* group, owned by Dan Mason and Walter Bell, of Terrace. The Department of Mines assisted the owners of claims on Thornhill mountain in repairing the trail this year.

NASS RIVER MINING DIVISION.

The mining centres of this Division are Anyox, where the Government Recording Office is located, and Alice Arm, which is the distributing-point for the Kitsault River valley and all its tributaries, the Illiance river, Alice arm proper, and its tributaries. They are served by the Grand Trunk Pacific and Union Steamship boats from Prince Rupert and Vancouver, each running once a week. A weekly mail-boat runs from Mill Bay, at the mouth of the Nass river, to Ayansh up the river. From Alice Arm the Dolly Varden Railway extends up the valley 18 miles to the *Dolly Varden* mine. From there is a good pack-trail to the Kitsault glacier, with branch trails extending up the main tributary streams.

There is also a first-class pack-trail up the Illiance river to its head, a distance of about 16 miles. From Ayansh there are trails up the river and throughout the valley, one across to the Illiance river and another south to the Kitsumgallum valley. The Division is therefore fairly accessible in all directions.

Very little prospecting has been done south of the Illiance river or north of the head of the Kitsault river, and as this portion of the Division is along the Eastern Contact Belt there should be good opportunities for the prospector.

This year the Division has had the most encouraging feature of the mining industry, in the continuous operation of the Granby plant, as well as one of the most discouraging, in the inactivity of the *Dolly Varden*.

Though there was more actual development being done in the Alice Arm district than elsewhere, the fact that the *Dolly Varden* was not shipping had a rather depressing effect on that community.

A good trail was built up the Illiance river and improvements made on the trail from the head of Hastings arm. A new wagon-road was constructed by the Provincial Government from the wharf-site to the town of Alice Arm, and the new wharf is now under construction by the Federal Government.

The Geological Survey of Canada carried out a survey of the upper Kitsault valley with a party under George Hanson, whose report and maps will likely be published early in the coming year. It is hoped that the services of Mr. Hanson can be obtained for next year for the extension of his work as a reconnaissance up the Illiance river, across to the Nass, and through to the Kitsumgallum Lake section, thus covering that portion of the Eastern Contact Belt mentioned above.

Granby C.M.S. & P. Co.*

The Granby Consolidated Mining, Smelting, and Power Company, Limited, has, fortunately, been able to operate its entire plant, with the exception of the "pilot" mill, continuously throughout the year, and from a quantity-production standpoint has had its most successful year since the smelter was "blown in" in March, 1914. During that time the company has produced from its *Hidden Creek* mines at Anyox approximately 200,000,000 lb. of copper. In order to maintain operations this year three separate wage reductions were made, on each of which a secret ballot was taken, resulting in a large majority in favour of continuance of work under a new lower wage scale rather than a probable shut-down with no work at all. The first of these reductions was at the first of the year, the second in April, and the last on September 1st, at which time a reduction of about one-third was made in the number of the mine crew and staff as well. Up to September the average number of men employed was 1,163; for the last four months, 926; or an average for the year of 1,084, against 1,277 for 1920.

Notwithstanding the reduction of labour, the tonnage mined was 896,802 tons, an increase of about 95,000 tons over last year, swelling the copper-output to 34,067,185 lb., an increase of nearly 9,000,000 lb., or about 35 per cent., over last year. The gold and silver yields were 7,652 oz. and 314,204 oz. respectively, each less per ton than last year, due to the fact that the quartz mined for flux from the *Rambler* carried no metal contents. Although there was a marked increase in the copper-output, the total value of the year's production will be considerably less than 1920 on account of the shrinkage in market prices of silver and copper.

No quartz was mined from the Granby Point quarries this year, but 22,500 tons was taken by the company from the *Rambler* claim just above the smelter.

The company's lime-rock quarries at Swamp point were not operated until April, the requirements for the first three months being drawn from storage. A total of 12,000 tons was mined during the balance of the year.

The greater portion of the 900,000 tons of ore mined and smelted was produced from the glory-hole and underground stopes above the 385-foot level, which is the main haulage level to the crushers, which are on the 230-foot level—No. 1 underground and No. 2 crusher on the surface, both discharging to storage-bins above the 150-foot level, the main haulage to the smelter. Also considerable heavy sulphide ore from No. 1 and No. 5 ore-bodies was hoisted from stopes above the 150-foot and below the 385-foot levels, the tonnage hoisted gradually increasing as the stopes became larger.

The large shrinkage stope in the No. 2 ore-body, which was started in 1916, was finished in the early part of September, making available such a large tonnage of ore that mining was discontinued in other parts of that ore-body. About 15,000 tons monthly was drawn from this stope during the last three months of the year. In the five or six years that this stope has been in operation there has been about 75,000 tons of what is considered high-grade ore broken, and it is worthy of note that during the mining of this large tonnage there was only one accident that resulted fatally and no others of any consequence.

In April contract stoping was started as an experiment in the No. 1 and No. 5 ore-bodies on the 150-foot level and has been continued throughout the remainder of the year, proving satisfactory in every way. There are two men in each contract, their pay depending on the footage they drill, the work being measured daily at the end of each night shift and the total footage drilled turned in to the office. The rates paid vary from 7 to 16 cents a foot of hole drilled, depending on the hardness of the ground, and the men never make less than day's pay and generally from $1 to $2 more. All machines, tools, etc., are supplied by the company.

Regular development continued uninterrupted up to September 1st, when owing to necessary curtailment all underground development ceased. The most of the development was done on the 150-foot and zero levels. The 150-foot level development was well along at the No. 1 and No. 5 ore-bodies, with only a few raises yet to be driven when work was stopped. The 10B crosscut has yet some 1,500 feet to go for the purpose of opening up No. 6 ore-body, and no crosscutting has been done in the direction of No. 2 ore-body. The zero level development consisted of crosscutting from the shaft, through the No. 1 ore-body, and into the foot-wall a distance of 400 feet.

Diamond-drilling continued throughout the year, encountering considerable extensions to ore-bodies, which materially increased the ore reserves. The diamond-drill was operated at the

* For general description of plant and mine *see* Minister of Mines' Report, 1917, and for coke and by-product plant, Report of 1919.

Bonanza mine for about three months during the summer, with very satisfactory results. This was the only work done in the *Bonanza* this year.

Many improvements in buildings and surface operations were made around the mine. The No. 1 and No. 2 bunk-houses were thoroughly renovated and added to. An assay office was started in June at the mine to handle the daily stope and drill-core work which had previously been done at the smelter assay office. A small dam was constructed on East Hidden creek to supply the increased demand for water for domestic and mine purposes. The No. 3 crusher unit, which was being built as an auxiliary to No. 1 and No. 2 crusher plants, was rushed to completion in January after the destruction by fire of the No. 2 unit on December 24th, 1920.

The most important new surface work was the reconstruction of the No. 2 crusher plant. The destroyed structure was built entirely of wood, reinforced with steel plate, and was always considered unsafe from fire. To prevent a recurrence of loss by fire, as well as to minimize repair and maintenance costs, the new plant was constructed of reinforced concrete. The structure consists of two cylindrical, reinforced concrete bins 24 feet in diameter, with walls 10 inches thick. Each bin is supported on twenty-four concrete pier foundations set on bed-rock and has a capacity of 750 tons of ore; these two bins are about 16 feet apart from wall to wall and between them is the crushing unit, enclosed by walls of metal lath and cement plaster. The building has three floors—feed, motor, and sampler—with oil, tool, and change rooms contained under one of the bins. The cost of the plant, including crusher, chute castings, electrical equipment, etc., complete, was about $50,000 and took about eight months to construct.

The coke and by-product plant was also in continuous operation throughout the year, producing 56,021 short tons of coke; 5,587 short tons of breeze or fine coke; 687,912 imperial gallons of tar; 9,189 imperial gallons of tar-paint; 2,162,155 lb. of ammonium sulphate; 213,485 imperial gallons of crude benzol; 188,738 imperial gallons of refined benzol; 61,000 lb. of naphthalene. The 100-ton "pilot" concentrator was not put into commission this year.

A great deal of scouting-work was done by the company this year and a great number of properties examined, but as yet no new work has been undertaken. With copper quoted at 13.55 cents for the average price for December, and the idle big producers anxiously waiting a little higher price to warrant a resumption of operations, it looks as if copper would remain about where it is for some time. It is understood that extensive work is contemplated by the company in the construction of a concrete dam that will provide ample power for all purposes the year round. H. S. Munroe is the general manager and J. A. Bancroft the assistant general manager at the plant at Anyox.

Golskeish Mines, Ltd.

This property, situated on Deep bay, about 3 miles from Anyox, has been producing and shipping to the Granby Company all year under the management of H. Heidman. The output of quartz, which is used for fluxing, was 9,203 tons, containing 943 oz. gold and 3,518 oz. silver. This is nearly three times the tonnage shipped last year and nearly double the amounts of gold and silver. Some barren quartz was shipped which reduced the average values, but the shipments made from the main pay-shoot averaged about the same as last year.

Hastings Arm Section.

Assessments were done for the year on the several properties situated up from the head of Hastings arm. A much-needed trail was repaired and cleaned out for about 8 miles by the claim-owners in that section, with assistance granted by the Department of Mines.

Alice Arm (Proper) Section.

Lime and Roundy Creeks.

The area at the heads of Lime and Roundy creeks is apparently a well-mineralized one and worthy of close prospecting. There is an old prospector's trail up Lime creek and a worse one up Roundy creek. The area warrants a good trail up the south side of Lime creek and some repairs on the Roundy Creek trail.

Lynx Group.

This is a restaking of the old *Cariboo* group. The old work consisted of a tunnel, now caved, about 50 feet long, driven across a hornblende dyke into a pegmatitic-looking formation in which occur small veinlets of molybdenum. Along the creek for 500 or 600 feet above the tunnel can be seen bands of quartz or quartz

porphyry up to several feet in thickness, alternating with wider belts of altered granite filled with quartz-seams, the whole carrying pyrites and molybdenum on the fracture faces.

Verona Group. This group consists of two claims—*Verona* and *Verona No. 1*—owned by Tom McCrostie, of Alice Arm. The claims are situated at the head of the South-west fork of Lime creek, at 3,250 feet elevation, and can be reached either by the trail up Lime creek or around by Roundy creek. The showing consists of a quartz vein from 6 to 24 inches wide, lying on the hanging-wall of a felsitic dyke about 6 feet wide which intrudes the slate or argillite country-rock. The vein strikes S. 10° W. (mag.) up the hill and dips 65° W., conforming with the strike and dip of the dyke, and from its evident connection with the dyke should be persistent. It has been uncovered about 400 feet farther up the hill. The quartz is heavily pyritized and there are also bands and bunches of mixed galena, pyrite, and zinc-blende. A sample of the mixed sulphides assayed 5 oz. silver to the ton and 9 per cent. lead. A sample of the galena assayed $2 a ton in gold, 33.7 oz. silver, and 23.5 per cent. lead. This is a rather promising little showing and warrants opening up.

Morley's Claims. These claims are situated on Roundy creek, 2,300 feet elevation, and about 1½ miles from tide-water in an air-line. The formation here seems to be a gneissoid granite that is either a shear-zone in the massive granite or the border of the granite near its contact with the argillite. Mr. Morley and two men were at work on the property and had done considerable open-cutting and stripping. A short tunnel also had been driven on a small quartz vein that was exposed in an open-cut above. The quartz vein lies in a siliceous belt about 50 feet wide, schistose along the sides near the massive granite, but more broken up in the centre, with small quartz veins running in all directions. The walls strike N. 45° W. (mag.) and stand almost vertically. One cut along the hanging-wall and above the present work shows a width of 6 feet or more of broken-up quartz and feldspar, with small veins of mineralized quartz and seams of solid galena, zinc-blende, and pyrites through it. A grab sample of the best-mineralized quartz-seams assayed $2 in gold and 142.5 oz. in silver to the ton.

This is an interesting-looking belt and with its width could easily develop a big tonnage of milling-grade ore. It is ideally situated for a tram-line to tide-water, straight down the gulch, which has evidently been formed by the erosion of the softer vein material.

Kitsault River Section.

The plight of the *Dolly Varden* mine has had a rather depressing effect on the town of Alice Arm from a business standpoint, and, of course, has not been much of a "boost" for the mining end of the section. However, the most serious phase of the situation is the question of transportation, due to the non-operation of the Dolly Varden Railway, and later made worse by the washing-out of a portion of the railway-grade and seriously damaging two or three of the bridges. It is vital to the mining development of the Kitsault valley, and consequently to the town of Alice Arm, that the railway be kept in repair, if only for the use of hand-cars for a time. This will practically eliminate any deleterious results from the inactivity of the *Dolly Varden* itself.

A great deal of prospecting and exploratory work has been done by the claim-owners throughout this section.

Independent Group.—This group, situated just above the town of Alice Arm, has had some further work done on the showings this year by the owner, Archie McPhail.

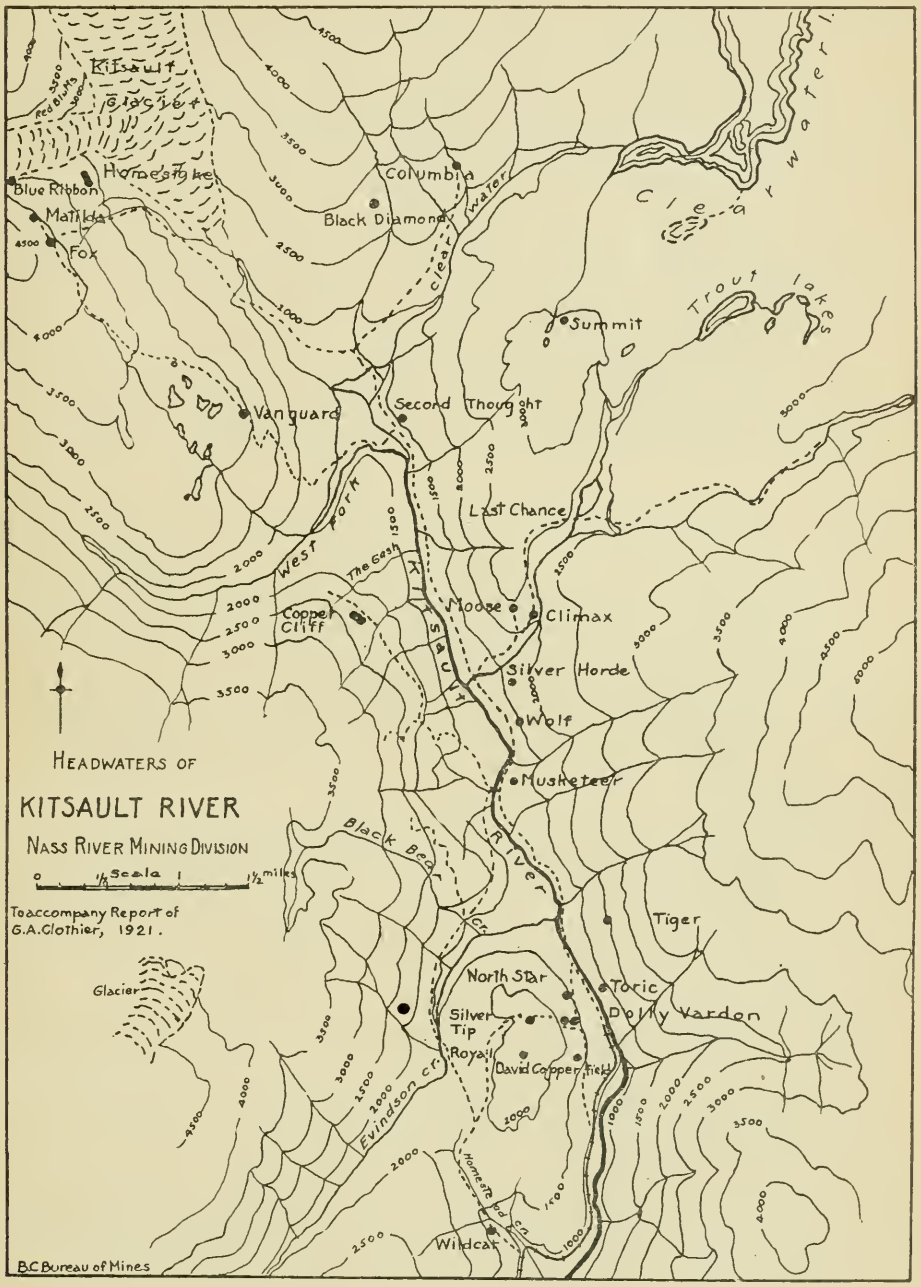
Black Bear or Esperanza Group. This group of three claims—*Black Bear*, *Aldebaran*, and *I Chance It*—was known in the early days as the *Roundy* property, having been staked and opened up by Frank Roundy, one of the first men in Alice Arm. Later it was acquired on a wage claim of a few hundred dollars by the Salinas Bros., who continued small shipments of high-grade silver ore each year. This spring the property was purchased by Mr. Elge, who has undertaken more extensive development-work, employing three or four men. He informed me that he was driving a crosscut tunnel about 150 feet long to get under some of the old upper workings, and at the same time drifting on a small high-grade vein that has just been opened up by Salinas. No shipments have been made yet, but he is confident that the ore taken from the drift will repay all expenditures. It is expected that shipments will be made some time during the winter.

Alice Arm La Rose Mining Co.—This company has not done anything this year on the *La Rose* group of claims on Paul Kladuc creek, which it acquired last year. (*See* Reports, 1919 and 1920.)

CORRIGENDUM.

Referring to page 51: The Consolidated Homestake Mining and Development Company wish to state that their company is not a reorganization of the Mineral Claims Development Company, and that their mineral holdings were not acquired from the Mineral Claims Development Company.

PROVINCIAL MINERALOGIST.



Wild Cat Group.

(*See* Report, 1918.) There are four claims in this group—*Wild Cat*, *Montana*, *Slocan*, and *Medallion*—situated on the west side of the Kitsault river, above the Homestake Creek bridge. The owner, A. Davidson, of Alice Arm, has been extending the tunnel toward cutting a fair-looking vein of copper ore about 2 feet wide showing on the surface.

Dolly Varden and Wolf.

These mines were operated by the Taylor Engineering Company, Limited. There has been very little activity on the *Dolly Varden* and nothing whatever doing on the *Wolf*. During the summer about 1,874 tons of ore that had been broken down last year was shipped to the Granby smelter at Anyox, yielding 45,648 oz. of silver. In the latter part of September a small crew was put on at the *Dolly* for the purpose of developing a showing of shipping-grade ore that had been recently discovered on the surface. This work, however, apparently proved disappointing, for the crew was laid off and the mine closed down. A further discouragement occurred this fall when a portion of the railway-grade was washed out and two or three of the bridges damaged.

The property is equipped with a 500-horse-power plant at the *Wolf* mine; a complete mine equipment at the *Dolly Varden;* an 18-mile railway from tide-water to the *Dolly Varden* mine; plenty of rolling-stock for the railway; capacious ore-bunkers at the beach and a spur to them from the main line; wharf, offices, repair-shops, etc., at the lower terminal of the railway. A good tonnage of milling-ore blocked out and a concentrator would go well with the property now.

North Star.

The Alice Arm Silver Mining Company, Limited, owns this property, which lies just north of and adjoining the *Dolly Varden*. Very little work has been done on the property this year. Last winter some ore was sorted out, rawhided down to the railway, and shipped this spring to the Granby smelter. The shipment was 85 tons, giving returns of 1,870 oz. silver. James McAleenan, of Alice Arm, has charge of the company's affairs.

Vanguard Group.

Owned by Maurice Petersen and the Strombeck Bros. The camp and showings are reached by a trail branching from the main Kitsault River trail at the *Second Thought* cabin. The trail continues from the *Vanguard*, along the side-hill, to the *Matilda* tunnel, which lies above the *Homestake* group. The owners are working each year on this group, but in their absence I did not examine the property this year. The reader is referred to the Minister of Mines' Report for 1918, page 65.

The *Tip Top* and *Fox* claims were also described in 1918 Report.

Matilda.

This claim is owned by A. E. Smith, of Alice Arm. It is located above the *Homestake* group at an elevation of 4,100 feet. It has been made easily accessible by the extension of the *Vanguard* trail, which also serves the *Tip Top*, *Fox*, and other claims. This trail was built by A. Smith and O. Flint with aid from the Department of Mines.

Work on the *Matilda* claim consists of a tunnel at 4,100 feet elevation, driven about 30 feet in a siliceous, pyritized greenstone. The strike of this greenstone-belt is S. 70° W., while the tunnel was driven on a bearing of S. 30° W., or diagonally across it. The last work done was a crosscut from the face, at 45° to the right, which would make its bearing on the strike of the mineralized belt. The face of this crosscut is quartz and feldspar, disseminated with coarse-grained iron pyrites, an assay of which gave low values in gold and silver. It is, however, a big strong showing and should be drifted on.

Blue Ribbon Group.

This group, consisting of the *Silver Tip*, *Silver Tip Fraction*, *Blue Ribbon*, and *Mountain Goat* claims, is owned by J. Fiva and H. Ness, of Alice Arm, who have done a very creditable amount of prospecting not only on these claims, but in the vicinity. The group lies above or west of the *Homestake*, north of and adjoining the *Matilda*, and south of the West arm of the Kitsault glacier. There is no timber on the claims and the camp cabin is therefore located on the north side of the arm of the glacier.

The prevailing country-rock of this group—in fact, of the mountain—is greenstone or green andesite. At an elevation of 3,000 feet, and about 100 feet above the glacier, the owners were driving an open-cut to hit a quartz vein seen cropping on the surface. The cut was in about 25 feet and still in a soft material, which obscured the vein, along the abrupt face of the mountain. The vein cropping above this shows a width of about 12 feet of quartz mineralized with pyrites, zinc-blende, and galena, parallelling the *Homestake* vein below it. On the surface the vein carries small values in silver and a trace of gold.

On the *Blue Ribbon* claim of the group, at an elevation of 4,575 feet and near the head of the West arm of the glacier, there is a belt of argillite about 100 feet wide cropping through the andesite on the north side of the mountain. Higher up the andesite can be seen overlying the argillite, which again crops on the south side of the hill. This belt has been badly crushed

and broken up and the fracture-cracks filled with calcite mineralized with chalcopyrite, with a little galena showing as well. Free gold can frequently be detected in the calcite and the fine, black, decomposed material pans gold freely. Samples of the pure chalcopyrite assay 34 per cent. copper and $2 in gold to the ton. A sample of several pieces of the calcite, showing a little chalcopyrite, assayed a trace of gold, trace of silver, and 1.8 per cent copper. It is very doubtful if the calcite stringers are numerous enough or carry sufficient values to make the whole a commercial ore. Some work would have to be done to get below surface conditions in order to obtain average values. There is a foot-trail leading up from the lower claims of this group and also a trail from the *Matilda* tunnel.

Homestake Group.

(*See* 1918 Report, page 64.) The Consolidated Homestake Mining and Development Company, Limited, whose head office is in the Credit Foncier Building, Vancouver, is a reorganization of the Mineral Claims Development Company, which was incorporated three years ago and acquired the *Homestake* group from the original owners, A. Davidson, Gus Pearson, and A. Smith, of Alice Arm. The holdings consist of the four claims—*Homestake No. 1*, *Homestake No. 2*, *Homestake No. 3*, and *Homestake No. 4*—situated 26 miles up the Kitsault river from tide-water, on the west bank of the lower end of the Kitsault glacier. It is about 8 miles from the upper terminus of the Dolly Varden Railway over the main Kitsault trail, which has been put in fairly good repair and fit for pack-horses. Though the property was taken over three years ago, this is the first year that any development-work of importance has been done.

The prevailing rock formation of Homestake mountain appears to be a green andesite. A number of open-cuts have exposed a mineralized zone or vein of siliceous rock up to 35 or 40 feet in width, carrying pyrite, chalcopyrite, and galena. The vein strikes about east-west (mag.) along the side-hill. On the lower side of the main vein one very promising cross-vein has been opened up by open-cuts, and other smaller veins were noted, all having a general strike of S. 70° W. up the hill, and therefore intersecting the main vein at an angle of about 20°. The same feature is shown above the main vein in the veins of the *Matilda*, *Tip Top*, *Fox*, and others, all striking about S. 70° W. into the hill. These cross-veins will no doubt have an important bearing on the mineralization of the main zone, in which enrichments may be expected at the points of intersection.

This year development of the property was undertaken, with Captain Gerhardi in charge and Major Creighton as foreman, with a crew of about twelve men. Tent camps were put up at 3,100 feet elevation by excavating along the steep side-hill. The main Kitsault River trail was put in shape from the Kitsault bridge to the camp, a distance of about 2 miles. Mining-work was started about August 1st and vigorously maintained until about October 15th. In that time No. 1 tunnel at 3,350 feet elevation was driven 123 feet, No. 2 tunnel driven 47 feet, and No. 3 tunnel faced up on the surface; in all, a very creditable amount of work. At the time of my examination No. 1 tunnel had been driven 107 feet, the last 4 feet showing mixed sulphides, pyrite, a little chalcopyrite, galena, and zinc-blende. Later information from Mr. Gerhardi is that, at 115 feet in, a 7-foot vein was cut through, averaging $45 in gold and 2.14 oz. in silver to the ton and 0.75 per cent. copper. It is expected that this tunnel will encounter the main vein in about 40 feet.

No. 2 tunnel is planned as the main working-level and will have to be driven about 600 feet to cut the main vein. It is further planned to install a compressor in the spring, driven by water-power developed from Helme creek; extend No. 1 tunnel to the main vein, on which a depth of 150 feet will be obtained, and do some exploratory work on it; and drive No. 2 tunnel. The property is certainly looking encouraging and, I believe, has a good chance of developing into a valuable producer.

Second Thought Group.

(*See* 1918 Report, page 63.) Some work was done this spring in open-cutting on the upper (or east) vein. This work shows a strong vein of brecciated quartz and slate, apparently on the contact of the slate and andesite, since the upper cut shows andesite on the foot-wall. There is no mineral of any account showing in these cuts. This vein strikes N. 72° W. (mag.) and dips 38° W., about conforming with the slope of the hill, and cannot be over 75 feet east of the lower vein. The lower vein about parallels this but dips at 65° W.; the veins would therefore come together at very little depth. Since I was on the property this summer, Jack Graham, one of the owners, has extended the crosscut tunnel on the lower vein a further 25 feet through banded quartz and

slate to an andesite formation in the face. No values of any account were found. The andesite here may be only a spur from the main mass, or it may be that the two veins have merged and the andesite is the foot-wall, as shown in the higher cuts. I would advise some drifting from the tunnel, where the best values were found.

Columbia Group. This group of five claims, owned by Pete Anderson and Fred Brown, is situated on the north side of Clearwater creek, about 2 miles from the *Second Thought* cabin. Pete has built a fair trail, branching from the main Kitsault trail above Clearwater creek, to his cabin, which is at 2,600 feet elevation. He has driven a tunnel 83 feet, following a brecciated vein of quartz and slate in a slate country-rock. No values were obtained on the surface on this vein and at only one point in the tunnel were any values found—$5.60 to the ton in gold. The owner insists on driving the tunnel, so I advised him to stay on the foot-wall of the vein and "go to it."

Summit Group. There are two claims in this group, owned by A. Davidson, D. W. Cameron, and O. Evindsen, of Alice Arm. The claims are situated on the divide between Clearwater and Trout creeks, at an elevation, where the work was done, of about 3,100 feet. An open-cut or trench was run for a length of 75 feet, following a shear-zone in greenstone porphyry, and exposing parallel seams of quartz across a width of from 10 to 12 feet, sparingly mineralized with galena. A tunnel 150 feet long was driven under this surface showing, but disclosed nothing except a few stringers of barren quartz cutting across the tunnel.

Last Chance Group. (*See* 1918 Report, page 62.) The owners of this group, Archie McPhail and Pat Morley, have done a lot of work on the showings since the property was diamond-drilled two years ago. A great deal of stripping and open-cutting has traced the vein for over 1,000 feet and some fine ore has been found. The owners have decided to run a crosscut tunnel from the foot of the hill to the vein, a distance of 200 feet, which will give about 140 feet depth on it. About 55 feet of this work was done this fall and will be resumed in the spring. Judging from surface indications, I think there is a good chance of opening up a big body of at least milling-grade ore, with probabilities of finding lenses of high-grade ore in the vein.

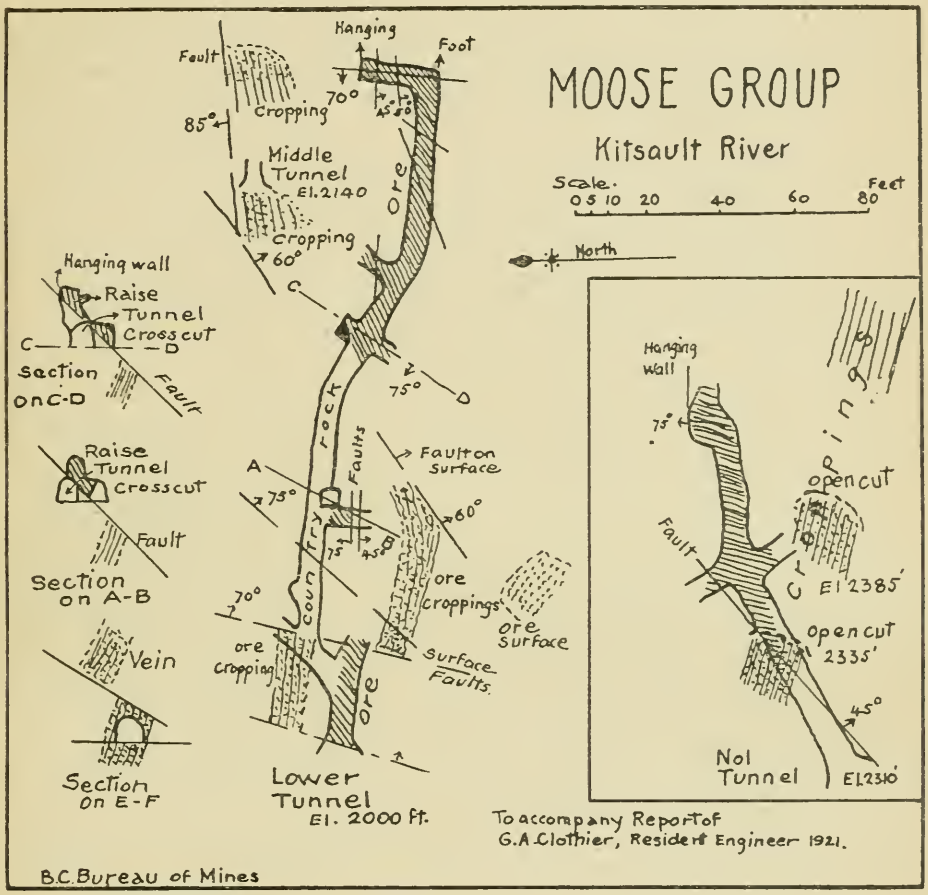
Moose Group. This consists of five claims—*Moose No. 1*, *Moose No. 2*, *Moose No. 3* *Moose No. 6*, and *Moose Fraction*—staked by Don Cameron, and owned by him and associates, of Alice Arm. The claims are situated on the north side of Trout creek, about 3½ miles from the Dolly Varden Railway. Last fall, 1920, a syndicate was formed in Vancouver, called the Moose Group Mining Company, Limited, and a lease and bond taken on the property. Camps were put up and a crew of men kept at work all winter. Before the snow came extensive surface prospecting was done by open-cutting, the winter work consisting of driving two tunnels, called the upper (or No. 1) and the lower (or No. 3).

The No. 1 tunnel, at 2,300 feet elevation (*see* sketch), had been driven about 35 feet by the owners for the purpose of getting under a good-looking surface showing that had been exposed in an open-cut. At the face the vein was shown to be about 12 feet wide, 6 feet of which would average 30 oz. silver to the ton. The company extended this tunnel 60 feet in ore of good milling grade all the way, selected samples assaying up to 600 oz. silver to the ton, and altogether giving very encouraging and satisfactory results. The No. 2 (or middle) tunnel, the position of which is shown on the accompanying sketch of the No. 3 tunnel, has been driven on the vein, but only a small amount of work has been done here.

The No. 3 (or lower) tunnel at an elevation of 2,000 feet, was started by the company and driven about 130 feet. The first 15 feet from the portal is on the vein, to a cross-slip which was followed to the left about 25 feet. Finding nothing along the slip, the tunnel was turned to the right and driven about 90 feet in country-rock on the bearing of the vein, about east, as shown in the first 15 feet of the tunnel. This work proved disappointing and work was therefore discontinued and the bond relinquished early this year.

The owners were, of course, disappointed in the results of the work and not altogether satisfied, so decided to "take another stack" in the game themselves. Their first work on the property this summer was to drive ahead through the slip, showing about 15 feet in from the mouth of the tunnel, and pick up the vein at that point. They then turned to the right from the face of the tunnel inside, found the vein in-place, and drifted 75 feet along the foot-wall. Crosscuts were driven to the hanging-wall, showing the vein to be from 10 to 22 feet wide. The

general tenure of the ore is low grade, with a little improvement on the hanging-wall side. Good ore was found on both sides of the slip followed in the crosscut at the face; in fact, the higher grade is always found at or near the cross-slips.



The details of the accompanying sketches, croppings, faults, slips, cross-sections, etc., were taken from a very interesting assay map worked out by D. W. Cameron, one of the owners. It is their intention to carry on development-work if the Dolly Varden Railway is put in repair, and so enable them to ship ore that can be sorted out as they go ahead.

Toric Group.

There are four claims in this group—*Toric*, *Anglo*, *Moose*, and *Lamb*—situated on the east side of the Kitsault river, a little north of and opposite the *Dolly Varden*. They extend from the river up the hill along the strike of the vein, which could be the extension of the *Dolly Varden* vein. The property is owned by the Strombeck Bros., of Alice Arm, and Al. Miner, who have done a very creditable amount of work in prospecting for and opening up the vein. The main vein, which strikes about N. 80° E. (mag.) and dips 65° N., has been exposed by a crosscut tunnel located about 150 feet above the railway-grade; several open-cuts above the tunnel tracing the vein for 500 feet or 600 feet up the hill; and several open-cuts and trenches on the upper claims. The tunnel shows a cross-section of the vein, of 5 feet of well-mineralized banded quartz and a reddish rock resembling jasper, on the foot-wall; then 8 feet of andesite country-rock; then 4 feet of vein without reaching the hanging-wall.

In one of the open-cuts about 500 feet above the tunnel some ore showing native silver was struck last fall. This year this was further explored and about a foot of high-grade ore exposed

on the foot-wall of the vein, which has here been crosscut for about 4 feet. This part of the vein is a breccia, consisting of a milky-looking quartz, fragments of andesite, and glassy quartz and jasper. The whole is mineralized with pyrite, argentite, and native silver, the latter occurring not only on the seams, but distributed in thin flakes and seams through the quartz. A crosscut was started about 30 feet below this open-cut to obtain further depth on the native silver showing.

I did not get to the upper showings, but John Strombeck informed me that in running an open-cut he crossed a 5-foot vein, an average sample of which assayed over 100 oz. to the ton in silver. With the vein traced for 600 or 700 feet on the lower end, and what is presumably the same vein exposed on the upper claims, and ore of good grade showing in several places, the property is looking very promising.

Ruby Group. This group, consisting of two claims—*Ruby* and *North Star Fraction*—lying south of the *Toric* group and east of the *Dolly Varden*, on the east side of the Kitsault, has been under option to J. C. Smith, of Seattle. No work has been done on the property this year, but in the two previous years about 100 feet of tunnel was driven. The surface showing consists of a broken-up andesitic dyke in which are veinlets of quartz showing little or no mineralization. To explore this an open-cut 12 feet long was made and continued in a tunnel 60 feet long, from which two or three crosscuts, the longest about 45 feet, were run to explore the ground at a depth of about 40 feet. There is nothing in the shape of mineralization showing in any of the underground work.

Silver King and Eagle. These claims are owned by Louis Forsberg, of Alice Arm, and are situated about half a mile south of the *Central* group and about 1½ miles from the Kitsault, at an elevation of 1,400 feet. The river is crossed on the cable at McFarlane's cabin and the trail followed down the east side of the river about a mile before climbing the hill. The trail should be cut from the river-trail up to the showings. The showings are quartz veins up to 3 feet in width, occurring in a shear-zone about 50 feet wide in andesite formation. The general strike of the zone is N. 15° W. (mag.) and the quartz veins, so far as shown, parallel the walls. The quartz is mineralized with pyrite and some galena and zinc-blende and carries $8 to $10 values to the ton in gold and silver, mainly the latter. Considerable open-cutting and stripping has been done across the zone, for the work of one man. On the hanging-wall there is a fairly well-defined vein exposed up to 3 feet in width, dipping about 70° E. On the foot-wall side of the zone an excavation about 4 feet deep shows a face of andesite in which are stringers of slightly mineralized quartz. I advised driving into the hill on the hanging-wall vein, gaining good depth, to ascertain if there was any improvement in values, which is frequently found with depth in this section. A crosscut could then be driven from this tunnel cutting the balance of the zone.

War Dance Group.—This group, situated up the East fork of the Kitsault, consists of six claims, owned by A. McGuire, of Alice Arm. He has done considerable work this year on this group and other individual claims. I understand that this and two other groups have been bonded.

Illiance River Section.

There has been considerable exploratory work done in this section this year, but unfortunately, the results have not been as favourable as expected from surface indications. However, the amount of work done has not been sufficient to gain any conclusive information.

Much-needed work in reconstruction and repairs was done on the trail, with appropriations from the Department of Mines. I understand that the trail is now in good condition for pack-horses all the way from the beach to the divide.

McGrath Mountain.—Assessment requirements have been kept up on all the claims in this vicinity, including the *Silver Bell*, *Lone Star*, *Silver Band*, *Standard*, and *Dixie* Groups.

Copper Creek Group. This group consists of five claims—*Black Diamond No. 1*, *Black Diamond No. 2*, *War Eagle*, *Little Giant*, and *Liberty*—and is owned by G. W. Morley and partner, of Alice Arm. The claims are located about a mile below Copper creek, or about 5 miles up from the beach along the Illiance trail. The owners have done a lot of work this summer in open-cutting along the hillside on the vein. This work shows the wall-rock to be diorite. The mineralization has been exposed across a width of 50 feet and consists of bands of black, cherty-looking quartz and a fine felsitic rock. The quartz-

bands are up to 5 feet in width and contain small stringers of steel galena and pyrite. A grab sample from the dump, not intended for an average but for the purpose of obtaining relative values, gave a trace of gold, 1.2 oz. silver, and 6.5 per cent. lead. The owners state that they have found high silver values in different places.

Bellevue Group. (*See* 1920 Report, page 51.) The Alice Arm Holdings Company, Limited, whose head office is at 614 Pender Street West, Vancouver, is incorporated with a capitalization of $1,000,000, in shares of $1 each. The *Bellevue* group, under bond to and operated by this company, consists of the five claims—*Bellevue No. 1*, *Bellevue No. 2*, *Bellevue Fraction*, *Snow Fraction*, and *Blenheim*—situated about 13 miles up the Illiance river from Alice Arm.

The rock formation in this portion of the Illiance valley is an altered porphyritic andesite, more or less schistose and slightly pyritized throughout. In this formation are belts or zones of soft schists, probably caused by intense shearing action, which have been replaced in part by lenses, stringers, and parallel bands of quartz mineralized with iron pyrites, zinc-blende, galena, and grey-copper, all carrying gold and silver values. There are apparently several of these mineralized zones, the most important so far being the one cropping at the south end of the *Blenheim* claim. Surface sampling of this by an examining engineer gave an average of 23 oz. silver to the ton across 15 feet. This surface showing is an exceptionally favourable-looking one.

This year's work, carried on through all last winter and up to late in the fall, consisted in driving a crosscut tunnel under the big outcropping, and two drifts from it, each about 30 feet long, on small lenses of ore crossed in the tunnel. In addition to the underground work, considerable surface work was done on another vein east of the one above the tunnel and seen cropping along the bank of the river. This work consists of a number of open-cuts and a small crosscut tunnel, all cutting the vein and showing it to be 3 or 4 feet wide, containing stringers up to 6 inches thick of fine-grain galena. As this vein is only a few feet above the creek and paralleling it, no depth of any account can be gained by crosscutting from the bank or by drifting on the vein. It is, however, well worth while sinking on anywhere between or at the two lower cuts, where the mineralization is the strongest. This vein lies along or very close to a strong diorite dyke which extends up and down the creek a long distance, and which probably has something to do with the mineralization found so close to it.

The tunnel and drifts driven last winter is a good piece of work and worthy of better results. It proved very disappointing in failing to find the extension downward of the big ore-showing on the surface. The tunnel was driven 280 feet, obtaining a depth of about 100 feet vertically beneath the vein-cropping and about 140 feet at the face. It crossed a considerable width in which occur small lenses and stringers of ore, which, however, are not big enough or continuous enough to make the ore of commercial value. Two short drifts were run on the best of these small showings, but did not amount to anything. I would advise the company that further exploratory work be done underground by driving the crosscut tunnel ahead until it is certain that the vein showing on the surface has been crossed, or until the cross-slip which shows on the trail going down to the tunnel is encountered. This cross-slip, running to the dyke, is also mineralized, and it is very possible that where it intersects the main vein, which parallels the dyke, is the point where there is a concentration of mineralization. It may possibly displace the main vein, and therefore further work is necessary to obtain more conclusive information.

All the work has been well placed and well done. Mr. Hughes, who has had charge of the work, is deserving of credit for the amount and quality of work he has accomplished with the number of men he has had employed and the difficult trail conditions with which he has had to contend. Altogether, the affairs of the company appear to have been well handled in a businesslike and efficient manner.

Silver Bell Group. This group, owned by Joe Hayes and associates, has had assessment-work done this year. The reader is referred to the Minister of Mines' Report of 1918, page 71, for a full description of the property at that time. Subsequent work has opened up some of the surface showings to a little depth, and I think the property would pay to operate in a small way by sorting and shipping the high-grade ore.

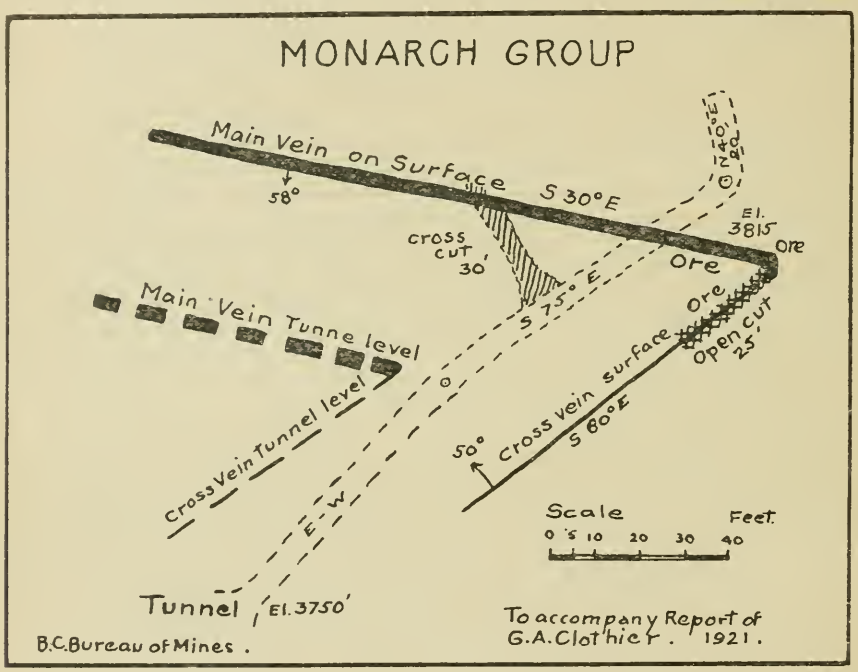
United Metals Mining Co., Ltd.—Nothing has been done on the property for the past two years.

Silver Star Group.

This group was further developed this year by the owners, A. R. Hodgson and associates. Last year a crosscut tunnel cutting the vein and a drift on the vein made a very encouraging showing. This year's work, however, consisting of more drifting and crosscutting, proved very discouraging, in that it was demonstrated that the small parallel veins or lenses of ore gradually diminished and disappeared in the soft gangue. Work was discontinued early in the summer.

Monarch Group.

There are two claims in the group—*Monarch* and *Monarch No. 2*—owned by W. B. Bower and associates. The claims are situated just to the right of Summit lake, the source of the Illiance river, on the divide between Alice arm and the Nass River valley and about 16 miles from tide-water at the head of Alice arm. A few years ago a crosscut tunnel (*see* sketch) was driven 144 feet for the purpose of locating the downward extension of a well-defined, well-mineralized vein that had been open-cut and stripped, exposing some very fine ore on the surface. The tunnel, however, failed to pick up the vein at depth and nothing further had been done on the property until

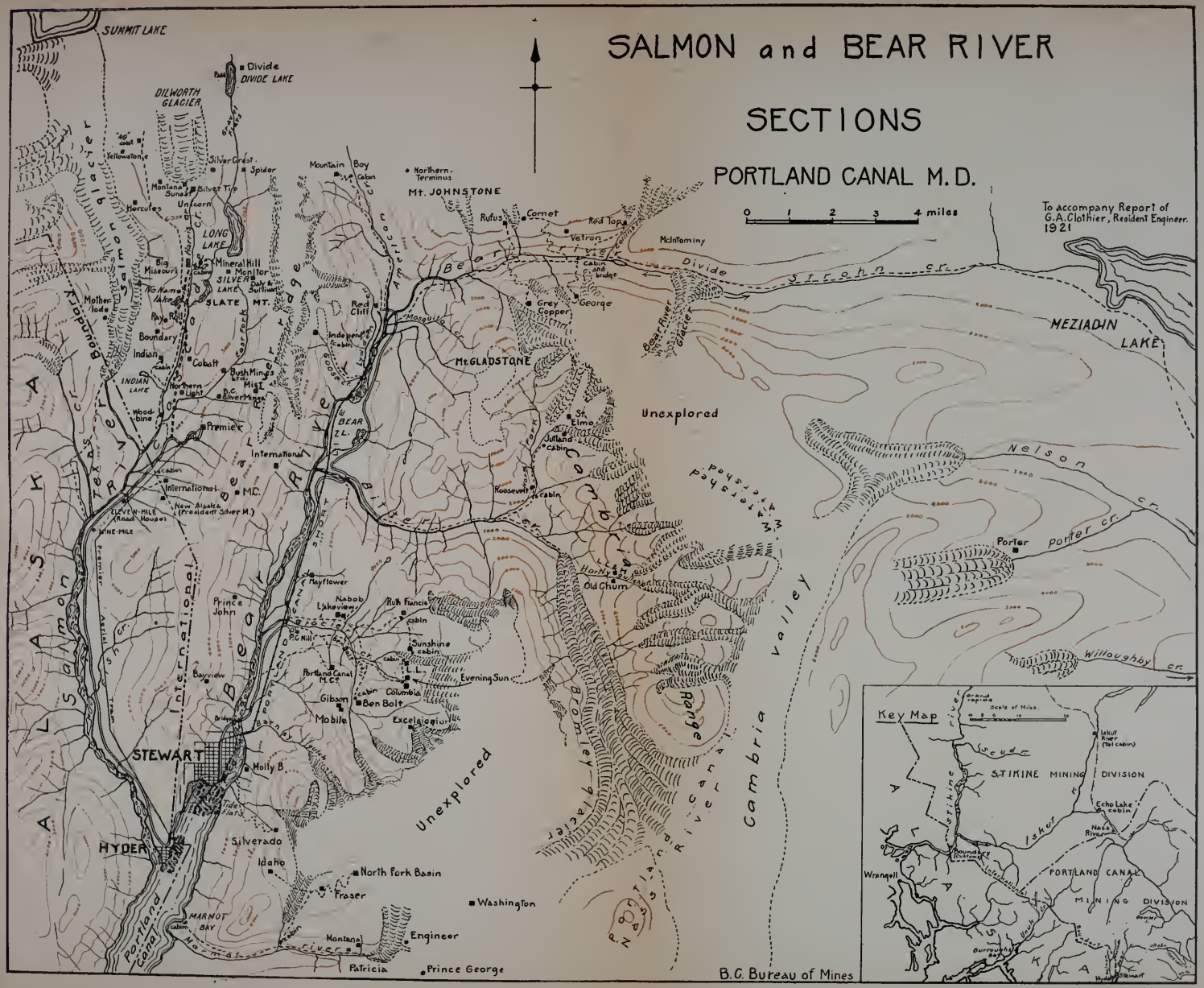


this year, when Bone & Hodgson procured an option on it. They first put in an open-cut on the cross-vein up to, but not through, the main vein. The face of this open-cut is 6 feet wide and 12 feet high and has a very fine showing of ore. A crosscut was then driven from a point about 90 feet in the tunnel to the left to cut this ore-shoot, but nothing was found. The crosscut is shown in the accompanying sketch, and I think it is too far in the tunnel and consequently under the foot-walls of both veins. I believe that a crosscut to the left, about 40 or 45 feet in the tunnel, or a short raise at 60 feet in from the mouth of the tunnel, would quickly prove whether the vein exists at that depth or not.

Glacier View.—This claim is situated about a mile beyond the *Monarch*, on the Nass slope, and is said to have a very promising showing. I have not seen the property.

Old Woman Group.

This group consists of four claims—*Old Woman No. 1*, *Old Woman No. 2*, *Old Woman No. 3*, and *Old Woman No. 4*—and is situated on the trail to Bowman lake, just over the divide on the Nass slope. They are owned by Henry Carney, of Alice Arm, and partners, who claim a big showing of considerable merit. I tried to find the showings from instructions, but lacking even a blazed trail from the main trail, I was unsuccessful.


SALMON and BEAR RIVER
SECTIONS
PORTLAND CANAL M.D.
0 1 2 3 4 miles
To accompany Report of G.A. Clothier, Resident Engineer. 1921
SUMMIT LAKE
Divide
DIVIDE LAKE
DILWORTH GLACIER
LONG LAKE
SILVER LAKE
SLATE MT.
Mt. JOHNSTONE
Mt. GLADSTONE
Unexplored
MEZIADIN LAKE
Nelson cr.
Porter cr.
Willoughby cr.
Cambria valley
Bear River Glacier
Salmon Glacier
Salmon River
Bear River
STEWART
HYDER
Portland Canal
Key Map
S.TIKINE MINING DIVISION
PORTLAND CANAL MINING DIVISION
B.C. Bureau of Mines

A good route for a prospector's trail from Alice Arm to the Nass river would be to follow the old Bowman trail from the 11-Mile bridge on the Illiance to Bowman lake, and from there down to a branch of the Tchitin river and that followed through to the Nass valley. From Bowman lake to the Nass would be, I should judge, about 12 or 14 miles.

PORTLAND CANAL MINING DIVISION.

This Division takes in all the country on the east side of Portland canal (the west side is Alaska) to the summit of the range, and all the upper basin of the Nass river from the White river, one of its tributaries, north. This latter portion of the Division, though over the Bear River divide, is included in it because it is at present more accessible by way of Stewart. Eventually there will probably be a good pack-trail or wagon-road built on an easy grade up the Nass river from Ayansh, the head of navigation, through to Meziadin lake and beyond. There is an old Indian trail through there now, but it is seldom used.

The town of Stewart, at the head of Portland canal, is the distributing centre for the Division and has the Government Recording Office. It is the most northerly seaport in the Province and is reached by Grand Trunk Pacific Railway boats from Prince Rupert, which make weekly trips in summer and fortnightly in winter, a gas-boat running from Rupert in the alternate weeks, carrying freight and passengers.

From Stewart to the heads of Salmon river and Cascade creek by way of Hyder and up the Salmon River valley is about 26 miles. Hyder is about 2 miles from Stewart, on tide-water at the mouth of Salmon river, and on the Alaskan side of the boundary. There is a first-class wagon-road between the two towns, built by the Provincial Government, to connect Stewart with the road up Salmon river. At present there is a good winter road to the *Premier* mine, about 17 miles from Stewart, which will be completed into a first-class wagon-road next year by the Alaska Road Commission to the boundary-line at 13-Mile. This road is being continued by the British Columbia Government from the *Premier* road a further distance of 7 or 8 miles up the valley. The upper part of the valley is now served by a pack-trail branching from the wagon-road at 13-Mile up the west side of Cascade creek to the *Forty-nine* mine, branching off to several other properties. There is also a trail from the wagon-road below the *Premier* following up the East fork of Cascade creek to the *Spider* mine. Prospectors working over the Salmon River divide, on the Nass slope, can have supplies packed to the *Forty-nine* or *Spider*, from either of which points it is about 8 miles over the divide to the foot of the glacier on the Nass side. It is good travelling over either glacier. That the Nass slope is a good prospecting country is evidenced by the samples of high-grade silver ore that have been brought in from that area.

From Stewart up the Bear River valley to the Bear River divide is 26 miles, of which the first 14 miles is over a fair wagon-road, from which there is a good pack-trail to the divide and on through to Meziadin lake and the Groundhog coalfields. The necessity of starting a trail branching from this on the east side of the divide and following north along the eastern slope of the Coast range for prospecting and exploratory work has been referred to elsewhere in this report.

There has been nothing doing on the Unuk River area this year. A trail from tide-water up the river to the mineralized area above the boundary-line is essential to the opening-up of this section, which is another small area of the Eastern Contact Belt lying on the Pacific slope, similar to the Salmon and Bear Rivers sections.

The Portland Canal Mining Division has probably felt the general mining depression the least of any part of the district, on account of the intense activity of the Premier Gold Mining Company, which has employed several hundred extra men throughout the year in tramway and other construction-work. Otherwise mining has been very quiet, except that there has been more than the ordinary amount of work done by individuals on their claims. The only other company operating in the Division is the Silverado Mining Company at Stewart. The prospector seems to have been exceptionally busy, for many samples of fine ore have been brought in from all directions. The prospector is at last getting down to business. It looks as if there might be a number of small shippers of high-grade ore developed in the coming year.

I am informed that the new Government dock at Stewart is to be enlarged as soon as the work can be gotten under way. It can be realized that the present docking and freight-handling

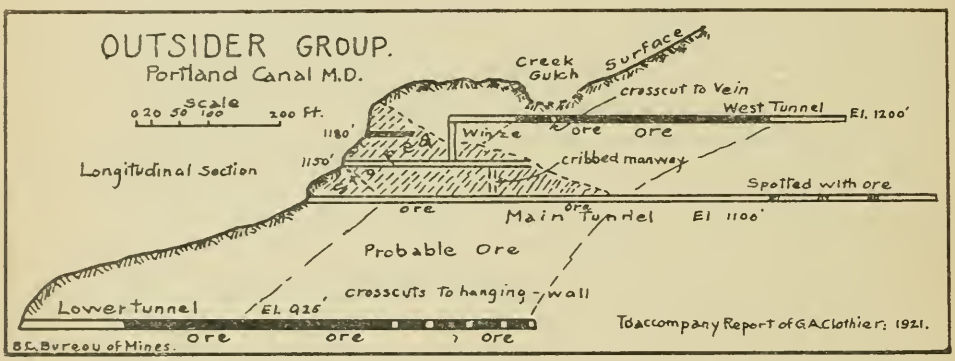
facilities are totally inadequate, when the Premier Company alone handled over 6,000 tons of incoming freight and shipped out about the same tonnage of ore.

The Summary Report, 1920, Part A, issued by the Geological Survey of Canada, contains the Preliminary Report of S. J. Schofield on the Salmon River area, giving valuable information regarding the geology and ore occurrences of that section. The geological map has been issued since the report and both may be obtained from the Mines Department, Ottawa. The detailed report should be out early in the year.

PORTLAND CANAL (PROPER) SECTION.

This area consists of the country bordering Portland canal on the east, from the mouth of the canal to its head at Stewart, and need not be confused with the Portland Canal Division. (See 1918 Report, page 73.)

Outsider Group. This group consists of eight claims—*Elsie, Tunnel Frac., Copper King, Regina, Hope, Brown, Summit,* and *Constance Frac.*—situated at Maple bay, about 35 miles down the canal from Stewart. The property was operated in 1905 and 1906, known then as the *Brown-Alaska*, shipping several thousand tons of 2.8-per-cent. copper ore to the Hadley smelter on Kasaan peninsula, Prince of Wales island. It is now owned by Martin Woldson and associates, of Spokane, Wash. They have done a considerable amount of work, driving the lower tunnel along the foot-wall of the vein for about 700 feet and running six crosscuts to the hanging-wall. (*See* sketch accompanying this report.) This tunnel is 175 feet vertically lower than the main tunnel from which the ore



was shipped, and in it the vein is shown to be from 8 to 16 feet wide, fairly well mineralized with pyrrhotite and chalcopyrite. The central portion of the vein is sparingly mineralized, while the walls, and especially the foot-wall, show a better grade of ore. There is probably 3 feet on the walls that will assay from 3 to 5 per cent. copper, but the whole vein would average probably less than 2 per cent. There is a small gold and silver content, a 5-per-cent. copper ore carrying from 60 cents to $1 in gold and silver values. The last 400 feet to the face shows a strong, well-defined vein in which will be found lenses of good ore along the foot-wall.

As shown in the sketch, nearly all the ore has been stoped out above the main tunnel to the surface. There is some ore left on either end of the stope; the outside end near the portal would yield a small tonnage through to the surface. The inside end shows 3 feet in width on the foot-wall, assaying 5 per cent. copper and 1.2 oz. silver to the ton, and might produce considerable tonnage, though the back of the stope for the last 50 feet shows the vein to have pinched down to about a foot of ore, of very good grade, however. A raise from the inside end of the stope on this level or a winze sunk on the ore showing in the west tunnel would give good information. Beyond the stope the vein seems to break up and only an occasional patch of ore can be seen.

The west tunnel has been opened up by a crosscut from the surface to the vein, a distance of 130 feet. The vein was then drifted on, 150 feet south and 400 feet north, exposing an ore-shoot 350 feet in length. The ore taken out in development was evidently shipped, as there are remnants of a tramway from the mouth of the tunnel around the hill to the old workings, from which the ore was lowered to the bunker, at the head of the aerial tramway, to the beach.

At an elevation of 2,100 feet, 900 feet above the west tunnel, there is a big outcropping of the same class of ore. It has been stripped for a length of 300 feet and shows an average width of about 10 feet. The surface is a decomposed, honeycombed quartz which, broken into, shows the same mineral content as the vein below. This is supposed to be another vein east of the one developed below.

Maple Bay Groups.

These groups, consisting of some twenty-two claims and fractions, situated at Maple bay, adjoining the *Outsider* group on the south, are owned by the original stakers, W. Noble, of Stewart, and associates. They are some of the oldest stakings in the Portland Canal Mining Division. The property was under option to the Granby Company three or four years ago, who put in a wharf, installed a compressor at the beach, put up about a mile of tramway from the beach to the tunnel, and drove a tunnel on the *Star* claim nearly 700 feet long. It is at an elevation of 375 feet; a tunnel was driven on the lower extension of the *Outsider* vein to within a short distance of the *Regina* end line, one of the *Outsider* group of claims.

The first ore-shoot is about 200 feet long from the mouth of the tunnel, but, as very little depth was obtained, the tonnage available to the surface was small. Some ore was extracted farther along on the vein, but work was finally discontinued and the plant, including the dock and tramway, was dismantled. No work was done on any of the showings on the upper claims of the group.

The trail to the higher showings branches from the wagon-road a little way above the point where the road crosses the *Star* tramway. The road starts from the beach, just south of the *Outsider* ore-bunker. The trail strikes across the flat to the creek, which it follows a short distance, then turns to the left and zigzags up the side-hill. It is badly overgrown across the flat, but is in good repair up the hill to the old camp on the claims at an elevation of 1,700 feet. From the cabin there is a trail along the side-hill, crossing the creek just below the canyon, to the showing on the *Thistle* and *Rose* claims, at 2,100 feet elevation. This vein, striking N. 10° W. (mag.) and dipping slightly to the west, has been exposed along the hill by stripping at intervals for a distance of several hundred feet. It is quartz up to 20 feet in width, lying in a greenstone formation, and sparingly mineralized throughout with pyrrhotite and chalcopyrite, with apparently a foot or two of better-grade ore on the hanging-wall. One exposure shows a lens of ore about 100 feet long and 10 feet in the widest place that I should judge would assay from 4 to 5 per cent. copper. A crosscut tunnel was driven, at 2,000 feet elevation, 175 feet through the greenstone country-rock to cut the vein, but the only showing in it is a 3-foot vein of barren quartz in the face and a few quartz stringers cutting across the tunnel. I think the tunnel should be extended a little to be sure that the vein exposed on the surface has been cut.

Above this vein another parallel quartz vein has been exposed on the *Anaconda* mineral claim. It has been stripped in five or six places and consists of a siliceous rock in which are lenses of mineralized quartz and small lenses and bunches of iron and copper sulphides. Considerable honeycombed quartz shows, probably an indication of sulphides below the surface. It is not so promising-looking as the *Thistle-Rose* vein.

To the east of this about 150 feet, and also on the *Anaconda* claim, another parallel vein has been traced for 300 or 400 feet by several open-cuts. It is shown to have a width of about 8 feet of fairly well-mineralized quartz. Its strike would indicate that it joins the big vein found on the *Princess May* claim farther up the hill.

Continuing up the hill to the croppings along the north side of the canyon on the *Princess May* claim, there is exposed a vein of quartz, 25 feet or more wide, which has been traced with open-cuts for about 1,000 feet up the hill. The lower cropping is at 2,900 feet elevation and the highest at 3,400 feet. The vein varies in width from 8 to 25 feet and has about the same mineral contents as the other veins on the property. Some good-grade chalcopyrite was noted on cross-slips cutting the vein at right angles.

From the *Princess May* showing it is about 2,500 feet north along the side-hill, at about the same elevation, to the outcrops on the *Eagle* and *May Queen* claims. A quartz vein about 20 feet wide is exposed along the north wall of a deep canyon in a country-rock of greenstone. The vein strikes N. 50° E. (mag.) and dips from 40° to 60° N. The vein is exposed for a distance of about 250 feet and is composed mainly of honeycombed quartz. Though no work has been done on it, it is a very promising-looking showing, for no doubt a little depth on this honeycombed quartz will find heavy sulphides. There is some enclosed greenstones in the vein and consider-

able residual limonite. It will be rather difficult to attack, since it lies in the bottom of a deep canyon with steep walls.

East of this vein and on the east wall of a small creek flowing into the canyon is a 6-foot quartz vein that will average from 5 to 6 per cent. copper. It parallels the 20-foot vein, but stands vertically, and may therefore be an offshoot from the larger vein. It seems to pinch out to the west across the canyon, but shows about 100 feet farther to the east. Though I did not follow it any farther up, it is said to be exposed in places for several hundred feet, showing in one place a width of 12 feet of 2.5-per-cent. copper and in another place 6 feet of solid sulphides. These showings on the *Eagle* and *May Queen* are the most promising on the property.

Altogether, there is apparently plenty of ore of about 2-per-cent. copper on the surface, and no doubt shoots and lenses of shipping-grade ore would be found in drifting on the different veins. Their situation is very favourable for mining and transportation.

Swamp Point.—The lime-quarries here, owned by the Granby Consolidated Mining, Smelting, and Power Company, are being operated on a comparatively small scale. Bert Wing is furnishing the necessary tonnage on contract.

B.C. Verde Group.

There are eight claims in this group, owned by H. McGuire, of Stewart. They are situated at the head of Bulldog creek, which flows into Portland canal about 6 miles below Stewart, and are at an elevation of 3,300 feet. The trail from the beach goes "straight up" from the mouth of the creek, where there is a small cove very convenient for a landing-place. The property is therefore very accessible and ideally located from a mining and transportation standpoint, the only requirement for the latter being an aerial tramway about 2 miles long from the workings to ore-bunkers on tide-water. From the point of loading to the Granby smelter at Anyox is about 120 miles of inside waterway suitable for scow-haulage. Transportation and treatment therefore offer no difficulties.

The claims were staked last fall and consequently the amount of work done is limited. The showings consist of siliceous lenses, mineralized with pyrrhotite and chalcopyrite, occurring as replacements in a grey andesite, mainly along the contact of the andesite with Coast Range granite. On account of the flat nature of the ground and the consequent heavy overburden of moss and muskeg, all exposures must be made by stripping and open-cutting. As the work so far consists only of a few open-cuts, none of the lenses have been sufficiently exposed to demonstrate their size.

At one point on the contact an open-cut shows a width of 10 feet of quartz fairly well mineralized with pyrrhotite and a little chalcopyrite. South of this, on the west side of a small lake, another shallow cut exposes a width of about 3 feet of fair-looking ore, across which a sample assayed 80 cents in gold and 3.4 oz. in silver to the ton and 1.5 per cent. copper.

The rock formation is locally very favourable for the occurrence of this class of ore, the surface silver values especially being encouraging. Further work in stripping, open-cutting, and sinking is warranted by the surface indications. Everything considered, the property is worth investigating.

Iron Cap Group.—This group consists of six claims adjoining the *B.C. Verde* group and also owned by H. McGuire. No work has been done on them.

Fraser Group.—There are two claims in this group, owned by George Fraser, and adjoining the two preceding groups. These have been recently staked and no work done on them.

Marmot River Section.

(*See* Minister of Mines' Report, 1919.) The Marmot river flows into Portland canal on the east side, about 4 miles below Stewart, from which it is reached by boat. Substantial assistance for trails was given by the Department of Mines during the year, and the section is one of the most accessible in the Division, though small in area.

The Coast Range granites extend up the river for about 3 miles, or about the mouth of the South fork, and beyond this is the Contact Belt. Judging from the several showings of high-grade ore, it looks as if this area would develop a number of small shippers of high-grade silver and gold ore, and the section is therefore very suitable for leasing and individual operating. It has been very active this year and gives good promise.

Patricia Group.

H. C. Magee, of Stewart, and Vancouver associates own this group of claims. It is composed of the *Patricia*, *Silver Link*, *Pat*, *Iron Mask*, and *Monarch*, and is situated on the north side of the main branch of the river, about 4 miles

from tidewater, from which there is a good pack-trail to the camp. At an elevation of 1,600 feet, about 500 feet above the camp, a tunnel has been driven 40 feet (October 4th) at the foot of a bluff, following a small quartz vein in solid granodiorite country-rock. The vein strikes N. 15° W. (mag.), stands about perpendicularly, and is from 6 inches to 1 foot in width. It is composed of quartz, galena, and pyrite, varying from slightly mineralized quartz to solid sulphide. The chief value is in gold, the galena carrying very little silver, and the best ore is a mixture of galena and pyrite, ranging up to $90 to the ton, of which $80 is gold.

At the mouth of the tunnel, which has been widened out to about 10 feet, for a length of 10 or 12 feet, for a blacksmith-shop, the vein lies on the east side and extends up to a slip near the top of the tunnel. This slip cuts diagonally down and across the tunnel and apparently throws the vein to the west 5 or 6 feet. The vein is on the west side of the tunnel from the inside of the shop to the face and has been left standing except for the last few feet at the face, which shows about 8 inches of solid sulphides in the bottom, the upper portion being more siliceous. Since my examination the tunnel has been driven 10 feet farther, showing about the same vein. It has been exposed on the surface in the bluffs above the tunnel about 20 feet beyond the mouth of the tunnel, showing a width of about 2 feet of mixed quartz and sulphide. The favourable situation of the property for mining and transportation should make this ore profitable to work on a small scale.

Mr. Magee informed me that there is a large mineralized belt high up in the bluffs striking at about right angles to the small vein, and therefore probably along the granite-contact. Samples from this belt assaying 200 oz. in silver to the ton have been obtained on the surface. He estimates that the present tunnel would encounter this belt in about 500 feet.

Mr. Magee is one of the first prospectors in the Marmot River section and certainly is deserving of credit for the amount of exploration and development work he has done.

Montana Group. There are seven claims in this group, lying north of the *Patricia* and owned by H. C. Magee and George Bruggy, of Alice Arm. The property was under lease and bond last year to the British Columbia Exploration Company, Limited, which did a little desultory work and obtained an extension of time on the bond. However, nothing further seems to have been done by this company. Shipments of a few tons of high-grade silver ore have been made from time to time, and it would therefore seem that further exploration and development of the property would be warranted.

Engineer Group. There are three claims in this group—*Engineer No. 1*, *Engineer No. 2*, and a fraction (name unknown). They are owned by George Bunn and Robert Stewart and situated on the east side of Marmot River glacier. They are reached by a pack-trail from the beach to the north side of the glacier; then across the glacier, which is good going for horses, to the mouth of the creek out of Magee pass, a total distance from tide-water of about 7 miles.

The work done by the owners this year consists of a 6-foot tunnel at an elevation of 2,650 feet, driven in on a brecciated vein of quartz and slate. The vein strikes S. 65° E. (mag.) into the hill and dips about 80° E. It is from 6 to 8 feet in width and fairly mineralized throughout with pyrite and chalcopyrite, with a foot of heavily pyritized quartz on the hanging-wall. It has not been traced on the surface beyond the tunnel. The country-rock is an altered sedimentary, apparently very close to the Coast granites. Judging from the amount of red and green andesite float along the north shore of the glacier, there must be a great mass of it higher up or many intrusions through the sedimentaries. This one exposure on the property looks very encouraging, but further work is necessary before attempting any conclusions as to its possibilities.

Prince George Group. This group consists of eight claims—*Prince George*, *Prince George No. 1*, *Prince George No. 2*, *Prince George No. 3*, *Prince George No. 4*, *Buena Vista*, *New Strike*, and *Cussedness Fraction*. They are owned by Woods, Newey, Donald, McNicholl, *et al.*, and situated on both sides of Magee pass, about half a mile up from the north side from Marmot River glacier. At present there is nothing but a goat-trail from the glacier up, skirting the canyon, and it will therefore be difficult to do much development-work until such time as a pack-trail is provided. There should be a trail built from the glacier to serve this group, the *Engineer* group below, the *Washington* group above, and other claims farther up the pass. It would require about 2 miles of trail, which would not be difficult to build. The two claims, *Buena Vista* and *New Strike*, lie on the south side of the pass in granite formation; the balance of the claims on the north side in the Contact Belt.

The only work done on the claims is on the *New Strike* and consists of a few shallow open-cuts put in along the bottom of a narrow, steep gulch possibly formed by the erosion of the softer vein material. These exposures are at 3,550 feet elevation, about 500 feet above the tent-camp site. They show the vein to vary from a seam in the granite to 4 feet in width of heavily pyritized quartz, showing some chalcopyrite and, in places, galena and zinc-blende. One cut discloses 1 foot of solid pyrite and 1 foot of pyritized quartz, the whole running probably 1 per cent. copper. It strikes S. 30° W. (mag.) into the hill and away from the contact and dips 65° W., showing a well-defined foot-wall.

The main values are in gold, the heavier mineralized quartz assaying up to $40 a ton; silver values run up to 10 or 12 oz., with additional values in lead in places. With improved transportation facilities this grade of ore could be made to pay, and the showing therefore warrants further development to determine whether the quantity and quality of the ore are sufficient to mine profitably.

Washington Group.

This group consists of several mineral claims, owned by R. E. Lundvall, of Hyder, Alaska, and Donald, Woods & Newey. The claims comprising the group are *Ellen*, *Ruth*, *Vivian*, *Carrie*, *Black Bear*, *Black Bear No. 1*, and *Castle Hill*, situated north of and adjoining the *Prince George* group and on the north side of Magee pass. The pass or gulch is evidently along the line of contact of the Coast granites with the interior sedimentaries, and the north side is therefore composed of highly altered rock. The country in this vicinity is badly broken up and distorted, probably accounting for the values found in so many different places.

One of the owners, Mr. Lundvall, drove a tunnel 80 feet during the year at an elevation of 3,950 feet, about 1,000 feet above the bottom of the gulch. The tunnel shows argillite, schist, and the face is now in what appears to be quartz porphyry, in which are small veinlets of quartz and iron sulphides. Values were found at different places along the tunnel.

Above the tunnel there are a number of oxidized-iron croppings showing diagonally up the hill. No work of any amount has been done on these, and it is a question whether they are formed from the surface oxidization of the mineral underneath or deposited from surface seepage of iron-impregnated water following down the crevices of the rock. If the tunnel was continued a short distance it would get under these croppings and prove whether or not there is mineral at depth.

Farther up the pass is glacier-filled, with the rock exposed along the banks. Some good-grade silver ore has been found and several well-defined veins have been traced for considerable distances, but the summer season is so short, transportation and every condition for mining so difficult, that little attention has been given them. A pack-trail from the south side of the Marmot glacier could be built by switch-backing up through the canyon to the present camp-site at 3,000 feet elevation, and is very necessary for the prospecting and development of this area.

Fraser Group.

This group is situated on the North fork of the Marmot river, about 3 miles up from the forks. There are seven claims in the group, owned by William Fraser, of Stewart. The area covered by the claims seems to be a mass of pyritized rock, so weathered and oxidized that the bluffs and rock-exposures are stained red and yellow across a width of probably 1,000 feet. What little work has been done shows a few quartz veins, mineralized with pyrrhotite, arsenopyrite, and traces of chalcopyrite, especially along the weathered seams, and said to carry fair gold and silver values. Its general appearance certainly invites prospecting and exploration. I am informed that a lease and bond has been taken on the property by Eastern interests.

North Fork Basin Group.—The owners, Fraser, Wood & Magee, of Stewart, will, with the improvement of the trail this season, now be enabled to make shipments of their high-grade silver ore.

Idaho Group.

This group consists of eight claims—*Gem of the Mountain*, *Lucille*, *Never Sweat*, *Prickly Heat*, *Nettie L.*, *Sunday*, *Slide*, and *Perseverance*—owned by Clay Porter, George Mehlfeld, J. McCallum, and Lee Levine, the latter two each owning a half-claim. The claims are situated about 4 miles up the North fork of the Marmot river, on the west side of the glacier, about 1,000 feet above it, and 4,000 feet above sea-level. Heretofore the property has been reached by following a North Fork trail to a short distance above the Government cabin, and from there up the glacier to a point at the bottom of the gulch below the camp. I understand that the trail was extended up the east bank of

the glacier to a point opposite the camp this fall, which will admit of pack-horses being taken from the beach to the end of the trail, and from there across the glacier about a mile to the foot of the hill. From this point a switchback trail can easily be built up to the camp. Ore can be lowered from the tunnel to the glacier, sledded across the glacier, and packed to the beach, a distance of 6 or 7 miles.

At an elevation of 4,000 feet the owners have driven a tunnel 80 feet during the past season, of which the first 40 feet had to be timbered. This follows a small seam of oxides, in which are small kidneys of galena carrying high silver values. The main vein was encountered at 80 feet and drifted on for about 10 feet at the time I was on the property, October 6th. This vein strikes N. 60° E. (mag.) and dips into the hill about 45° N. It consists of siliceous material about 2 feet in width, lying in the prevailing country-rock at this elevation of andesite schist. On the foot-wall there is about 6 inches in width, in which are lenses of galena carrying silver sulphides, probably stephanite, assaying from 400 to 1,950 oz. to the ton in silver; the balance of the vein of 18 inches is a siliceous rock mineralized with fine-grained iron pyrites and probably silver sulphide, though none were seen in hand samples, assaying from 300 to 400 oz. to the ton in silver. The owners were sacking ore, but I believe did not get any shipped before winter necessitated closing down the work.

Porter and Mehlfeld, who were on the property, stated that they had discovered several small parallel veins of similar high-grade ore above the tunnel, and two large veins of quartz carrying grey-copper, resembling the *Silverado* veins, on the Portland Canal side of the summit and at no great distance from the *Idaho* group.

The values in and size of the showing on which they are working are certainly very promising for profitable mining, and altogether the owners are very optimistic of the probabilities of their holdings. They surely deserve credit and success for the work they have accomplished under most discouraging conditions.

North Fork Basin.—This basin is of limited area and has been practically entirely staked. With a good trail it is very accessible and handy from the beach and justifies very close, thorough prospecting for the characteristically small high-grade veins.

Bear River Section.

(*See* the contour and mining property map of Bear, Salmon, and Marmot Rivers sections accompanying this report.) The reader is also referred for geological data to Memoir No. 32, by R. G. McConnell, published by and obtainable from the Geological Survey of Canada, Ottawa. This is one of the important sections of the North-western District and includes all the country north of the head of Portland canal, tributary to the Bear river, to Bear River divide.

The Portland Canal Short Line Railway extends from Stewart to the *Red Cliff* mine, 14 miles up the valley, and there is also a fair wagon-road covering the same distance; from there on a good pack-trail extends over the divide to the Groundhog coalfields. It was realized when the railway was built that this valley, with its low divide at the head of Bear river, is the logical outlet for all the northern interior part of the Province lying east of the Alaska strip, and doubtless it will some day be utilized for that purpose.

It so happens that the break in the Coast range occupied by Portland canal and its extensions, the Salmon and Bear River valleys, throws a portion of the Eastern Contact Belt, about 20 miles long, on the Pacific slope, but there are about 60 miles north of this break to the Iskut river of the same mineral-belt lying on the interior or eastern slope of the range and only accessible by way of the Bear River valley. A start should be made toward the exploration of this belt by starting a trail, branching from the Bear River trail on the other side of the divide, northwards along the eastern slope on the mineral zone.

Mining, so far as outside operators were concerned, was at a standstill in this section until the Silverado Mining Company started, but much prospecting and developing was done during the year by property-owners. It is hoped that improved money conditions will enable the smaller mining operators to take over and develop some of the promising propects of the section. Apparently, the larger companies are content to wait and pay for a developed property rather than take a chance on developing a mine from a prospect.

Silverado Group.

The Silverado Mining Company, Limited, was incorporated in October, 1921, with a capitalization of $200,000, divided into 2,000 shares; the head office of the company is in the Vancouver Block, Vancouver. The company's holdings consist of the *Silverado* group of five claims—*Silverado No. 1, Silverado No. 2, Silverado No. 3,*

Rainier Bluff Fraction, and *Silver Bell No. 4*. They are situated on the east side of the mouth of Bear river, just south of the glacier opposite the town of Stewart, at an elevation of about 4,000 feet. The group was staked and owned by John Haahti and J. W. Stewart, of Stewart.

The property was acquired by J. J. Coughlan, of Vancouver, in August, and work started in the latter part of that month. Previous to this it had been under lease to Haahti & Peterson, who had driven a tunnel 30 feet long and done some little stoping, extracting about 15 tons of ore. This was sorted to two grades, the first class being a clean grey-copper assaying over 600 oz. to the ton in silver and the second grade assaying between 250 and 300 oz. to the ton in silver. The vein as exposed by this work, as well as the cropping along the bluff, is from 6 to 18 inches wide and lies horizontally in grey andesite country-rock. The gangue is quartz uniformly well mineralized with grey-copper and pyrite, the former predominating, and averaging better than 125 oz. to the ton in silver. The pure grey-copper assays about 1,000 oz. to the ton in silver. This small vein is exposed for a length of 200 feet or more along the base of the bluff at 4,200 feet elevation, and, judging from the quantity and quality of ore extracted, there is probably over $35,000 worth of ore exposed.

A small shipment of ore was made in 1921; 5 tons of "low grade" gave an assay of 299.36 oz. of silver to the ton and 3.62 per cent. of copper; 2 tons of "high grade" or hand-sorted grey-copper assayed 696.6 oz. of silver to the ton and 7.76 per cent. copper.

Since the present owners took over the property a great deal of outside work has been done under most unfavourable weather conditions. A trail about 5 miles in length was built from the east bank of Bear river to the upper camp at 3,850 feet elevation. Camps were established at 1,700 and 3,850 feet elevations as terminals of a tramway, the upper terminal camp to be utilized later for the mine camp. A 2-bucket tramway nearly a mile in length was constructed and the upper terminal connected with the tunnel by a single-cable tram about 1,000 feet in length. Ore can therefore be lowered to the lower camp, from which point it will be rawhided to the beach.

It was realized that a complete tram from the mine to tide-water could not be built in the limited time before winter; consequently the upper portion only, covering ground that will be impossible for winter transportation with horses, was built this season. It will very probably be completed to the beach next season.

There are two large, almost vertical, veins above the small flat one now being worked which can be attacked for development around the north side of the hill on a level with the present tunnel. These veins are from 3 to 6 feet wide and consist of quartz well mineralized with grey-copper and pyrite. On account of a light snowfall I was unable to see them, but from a description I judge that they will very probably develop a sufficient tonnage of good-grade milling-ore to justify the erection of a milling plant. The property has, with the small high-grade vein paying its way, a very favourable chance of becoming an important producer.

Mobile Group. This group is owned by H. P. Gibson and Louis Legge, of Stewart, and Al. Harris, of Vancouver. It consists of four claims, situated at an elevation of 3,700 feet on the east side of Bear river, just south of the claims of the Portland Canal Mining Company. The showings are reached by the old Portland Canal mine-trail, passing the mine camp and continuing on up the hill for less than a mile. There is a splendid camp-site right at the showings, with plenty of timber for cabins and fuel.

No development-work has been done other than the necessary yearly assessments, consisting only of open-cuts and stripping, the greatest depth obtained being about 10 feet. The lowest cut is at 3,700 feet elevation and the highest at about 4,000 feet, tracing the vein several hundred feet on the surface. Fair depth could be obtained by drifting on the vein from the lowest cut, or even greater depth by tracing the vein farther down the hill to start a drift. The cuts show an oxidized width up to 6 feet, in which are ribs of quartz and slate with quartz through it up to 24 inches wide. The quartz is mineralized with pyrite, galena, and zinc-blende, and carries varying amounts of grey-copper, argentite, and ruby-silver. The general rock formation is argillite (McConnell's "Bitter Creek formation") and its contact with the greenstones cannot be a great distance down the hill. The mineralization appears to be a sheared zone in the argillite, replaced by bands of quartz for a width of from a few inches to 24 inches, the balance of the vein being an oxidization through the soft, sheared material. I do not think that quartz for the full width of the shear may be expected.

Tide Lake, on Salmon-Nass Rivers Divide.

Mitre Mountain, on Salmon-Nass Rivers Divide.

The solid quartz, varying from 4 to 8 or 10 inches wide, carries the values, and not the quartz found as stringers in the slate. A sample of three or four pieces of quartz from about 4 inches of width in the lowest showing, mineralized with pyrite and a little galena and grey-copper, assayed 103.4 oz. in silver to the ton. An average sample from several cuts, representing ore that would be sorted out and shipped, and varying from 4 to 10 inches in width, gave assays of $2.80 in gold and 314 oz. in silver to the ton, 11 per cent. lead, and 4 per cent. zinc. A persistent streak of a few inches in width of this grade of ore could be mined profitably. The vein could be worked in as many places as desired on the surface, taking out the ore to a depth convenient for handling; at the same time a drift could be run on the vein at a lower level to determine what the conditions were at depth.

A trail could be easily built from the Portland Canal mine trail and the ore packed on horses down to the wagon-road at the Portland Canal concentrator, and from there hauled to the dock for shipment, a distance of about 5 miles. If the ore developed sufficient tonnage an auxiliary tram could be run from the workings down to the head of the Portland Canal tram, and this latter utilized to take the ore to the wagon-road at the lower terminal. The propery might make a very profitable little shipper.

Dandy Group. This group consists of four claims—*Dandy No. 1*, *Dandy No. 2*, *Star No. 1*, and *Star No. 2*—the first two being restakings of two of the claims of the old *Main Reef* group. The owner is Heine Horstman, of Stewart. The claims are situated on the east side of Bear river, about half-way between Glacier and Bitter creeks, at an elevation of 1,600 feet. There is a good trail to the old camp from the Bear River wagon-road, passing the *Tyee* cabin at 425 feet elevation and the *Mayflower* camp at 900 feet elevation.

The vein on the *Dandy* claims is about 4 feet wide, of broken-up argillite crossed with small quartz stringers, with a continuous small vein of quartz on the hanging-wall mineralized with zinc-blende and galena, principally the former. It lies in argillite country-rock on top of a greenish porphyry dyke about 40 feet wide. It strikes N. 30° W. (mag.) and dips 63° W., conforming with the strike and dip of the dyke.

The vein cuts diagonally across the creek and here shows only a seam of ore on the hanging-wall containing very little values. On the west side of the creek a tunnel was driven a considerable distance in the early days, but the mouth of it is now blocked up by a jam of debris in the creek, which has piled the creek-gravel over the top of the tunnel. This tunnel could not have gained much depth in a couple of hundred feet, as the surface above does not rise very rapidly. A shaft is said to have been sunk to a depth of 40 feet just inside the mouth of the tunnel, following a shoot of good ore from 12 to 14 inches wide all the way down, but I doubt it from the appearance of the rest of the vein exposed. However, it would not be a difficult undertaking to clear out the creek and get into the tunnel to unwater the winze. If there is a foot of $75 ore, or even less, in the shaft, it will pay to mine and ship, as it is not over 2 miles down to the wagon-road and a 6-mile haul from there to the dock.

Tyee. This is one of the old properties worked on in the early days of the camp and is owned by Jim McKay and Charlie Bibeau, of Stewart. A shaft was sunk about 40 feet on a heavily pyritized vein, about 4 feet wide, of quartz and altered granite occurring in a granite stock. The ore carries some gold and silver values, but not enough to ship. The sulphides are too heavy to admit of sufficient concentration to raise the values to a shipping grade. A crosscut tunnel is now being driven by the owners to cut the vein, I should judge, a little lower than the bottom of the shaft and some distance to the north.

Evening Sun and Columbia. These claims were reported on in 1919, since which time, W. W. Rush, the owner, has been working on them each season. I did not get up to them this year, but Mr. Rush informed me that he is continuing the tunnel on the *Evening Sun* claim, and that conditions have not materially changed since the last examination was made.

Excelsior and Eagle. These claims belong to W. W. Rush, of Stewart, and A. Baggs, and were also reported on in the Minister of Mines' Report of 1919, page 72. Mr. Rush was working on the claims this summer, driving a tunnel on what he calls the "spur" vein. This is now in about 30 feet, with high-grade ore up to a foot in width all the way. A depth of 25 or 30 feet has been gained at the face.

Other Claims.—Nothing new is reported on the *Lakeview*, *Sunshine*, and *L. & L.* groups, described in the 1919 Report; the *Ruth and Francis* claims, in 1918 Report; or the *Dunwell*, in 1920 Report.

L.L. & H. Group. This group was under bond to Charles Tubman, of Victoria, last year, and was briefly described in last year's report. This year Mr. Tubman found it impossible to finance further work and the property was returned to the owner, Jack Harkley, of Stewart. Mr. Harkley and two men are working on the property all this winter, driving the crosscut tunnel ahead for the purpose of cutting all the veins exposed on the surface. No information is available as to the results of the work to date.

George Copper-mines.—Further work was done by the owners this year, mostly in trail-building. The property has been fully described in former reports.

Red Top Group. This group was reported on last year, when it was under bond to G. Seiffert, of Seattle. He was, however, unable to go ahead with the work this spring and the bond lapsed, the property reverting to the owners, J. McNeil and J. J. Connors. They have been working, continuing the lower tunnel near the cabin, which Mr. Seiffert had driven 132 feet toward crosscutting a surface exposure of copper ore. Nothing is known as to the outcome of this season's work.

Vetron and Comet Groups.—Yearly assessments were done by the owners, Ben Erickson and W. Forrest. The reader is referred to last year's report for descriptions of the property.

Red Cliff Group. The property of the Red Cliff Mining Company, Limited, was purchased in the spring by R. W. Wood and associates. This summer a small crew under the supervision of R. L. Clothier, of Stewart, did some surface work on the showings on the upper claims. Values, however, did not prove encouraging and work was discontinued.

Independent Group. (*See* 1919 Report.) This group is situated on Goose creek and consists of six claims, owned by Sam and Jack Fitzgerald, of Stewart. Last year the property was under option to the Algunican Development Company, a Belgian syndicate under the local management of W. A. Maloche, which has since become defunct. This company put a diamond-drill on the ground and drilled two holes totalling 508 feet. The drill-station was about 120 feet south of the vein exposed on the surface by an open-cut. The vein strikes N. 65° to 70° W. (mag.) and dips 70° to 75° S.W. toward the drill-station. The first hole, 240 feet deep, was on a bearing of N. 7° W. at a declination of 31°, and would therefore intersect the vein at about 150 feet from the collar and at a depth of about 100 feet on the vein. The ground proved soft or broken up at this point and a very poor core was obtained and values were reported low. The other hole was 268 feet deep, flat, and on a bearing of N. 45° W. (mag.), and therefore was about 75 feet from the vein when stopped.

This year's work was done lower down the hill at 1,750 feet elevation, about 1,400 feet below the cut on the vein near the drill-station, and consists of a tunnel driven 25 feet, intersecting a vein seen cropping above. The face had just reached the vein, and a small sample taken therefrom gave a trace of gold and 3 oz. in silver to the ton and 1.5 per cent. copper. The vein is quartz showing considerable chalcopyrite and pyrite in places. The country-rock is andesite.

At an elevation of 3,150 feet, the level of the drill-station, the open-cut on the vein has exposed it for its full width of 14 feet. Across the face of the cut, which is about 10 feet high, the main portion of the vein is shown to be about 5 feet wide and to occupy the centre of the vein. This portion is heavily pyritized quartz, with some galena and zinc-blende, in which the principal values are silver, with a little gold. On the hanging-wall side of this is a small basic dyke about a foot wide, and bordering the quartz and dyke on each side is a siliceous rock in which are bands of quartz and a reddish, jaspery-looking quartz, also heavily mineralized with pyrite, and traces of galena and zinc-blende. The mineralization is much stronger in the bottom of the cut. Average values of $12 a ton are claimed across the whole 14 feet.

Farther up the hill at 3,500 feet elevation an open-cut has been driven on a vein about 8 feet wide, with a porphyritic dyke showing on the foot-wall. This vein strikes N. 65° W. (mag.), stands about perpendicularly, and is thought to be the same as disclosed in the 3,150-foot open-cut. The gangue is a mixture of quartz, calcite, and the reddish quartz resembling jasper, the same as in the cut below, contains considerable pyrite and traces of galena, and is

claimed to assay $10 to the ton in gold and silver across the 8 feet. Judging from the sulphide contents, the ore would concentrate from 10 to 15 into 1. The gangue here has a marked resemblance to the *Toric* vein, in the Kitsault River section, in the same rock formation—andesite.

Farther up the hill, probably 75 feet, and to the north of the last showing (apparently a dyke intervening) is another showing about 20 feet wide of the same kind of vein-filling. Only a couple of shots have been put in here, but the freshly broken rock shows about the same mineralization as in the previous cut. A sample of a number of pieces broken out by the shots assayed 80 cents in gold and 28 oz. in silver to the ton and a trace of copper. With their fair silver values for the surface, these upper showings look very promising to me and I would confine future work to them rather than to the tunnel or cuts below.

M.C. Group. This group was staked last fall by C. A. Mackenzie, of Victoria, and consists of the following six claims: *M.C.*, *M.C. No. 1*, *Britain*, *Britain No. 1*, *Nine of Hearts*, and *Nine of Hearts No. 1*. They are situated on the crest of Bear River ridge, beyond the *Prince John* group, at an elevation of about 6,000 feet. There were two or three men working on the claims for a time this summer, but as there was no one there at the time I was in the section I did not get up to them. I have no information as to the showings, work, etc.

Prince John Group. (*See* Report of 1919.) This property is situated on the west bank of Bear river, about 5 miles above Stewart, and is owned by J. Nesbitt and Andy Archie. There has been considerable work done on the claims by way of open-cuts, stripping, and crosscut tunnel at 2,350 feet elevation, driven 185 feet across the formation. The cross-section exposed in the tunnel shows 35 feet of greenstone-schist from the portal; then 45 feet of banded slate mineralized with pyrite and chalcopyrite, disseminated in grains throughout the slate, and in small veins and bunches along the bedding-planes and cross-fractures; then 45 feet of a light-grey acidic dyke; and beyond that 65 feet of slightly mineralized slate to the face. The 45-foot section of ore would probably average about 2 per cent. copper and $1 to the ton in gold and silver values.

Some further surface work was done this summer by Mr. Nesbitt and some beautiful specimens of free gold found. It occurs in the banded slate, in which the sulphides have been decomposed and replaced with a spongy gold. I tried to get up to see the work, but on account of high water we were unable to get along the river-bank.

This and all the claims along the west side of Bear river, from the Government bridge to Bitter creek, have always been badly handicapped in having no trail along that side of the river.

Bayview group was reported on last year and nothing has been done on it this year.

Salmon River Section.

This portion of the Portland Canal Mining Division is the drainage-basin of the Salmon river in British Columbia, and represents about 7 miles in length and about 60 square miles on the Eastern Contact Belt, which is here conveniently situated on the Pacific slope of the Coast range.

The area has been given a great deal of prominence by the remarkable development of the *Premier* mine, which has this year shipped about $1,750,000 worth of gold and silver, and, furthermore, has exposed ore valued at many more millions. This will undoubtedly guarantee the exploration and development of the remainder of the basin, in which there are many meritorious showings. It also gives an idea of the potentialities of that portion of the same mineral-belt extending 250 miles north to the boundary of the Province. This mineral-belt is one of the greatest assets of the Province, and it should be its endeavour to open it up wherever feasible by the construction of trails and roads and improvements to navigation.

In this Salmon River section the lower end of the basin is served by a wagon-road from Stewart to the *Premier* mine; beyond this is reached by trails, which have served their purpose for prospecting and partially developing the upper valleys. That area is now past the prospecting and hand-work stage and requires the extension of the wagon-road for another 5 or 6 miles to provide means of transportation for taking in machinery for more extensive development and taking out helpful shipments of high-grade ore showing on many of the properties. About 2 miles of this road was built two years ago and the continuation of this, even as a winter road, would be most useful. The present trails should be extended over the Salmon

River and Long Lake divides to the Nass slope, and thus enable prospectors to get supplies into that country and explore it with some degree of efficiency, and so extend the known mineral areas.

Outside of the operations of the Premier Company, the section has had a very quiet and uneventful year in mining. Though there has been a lot of individual work done, there has been no development of importance and few, if any, properties are in better condition than last year. The quiet year may, however, prove beneficial, in that it may do away with the inflated valuation placed on properties which are as yet only in the prospect stage in this and other sections where there has been a little mining activity in the past two or three years.

There are several properties on the Alaskan side of the boundary, both in the Fish Creek basin and on the east side of the Salmon River valley, that have had an appreciable amount of development during the year and are reported to have the ear-marks of becoming important producers.

It is worthy of mention that the Alaska Commission has definite plans regarding the construction of a wharf and approach at Hyder, and that appropriations have been made for this work and the completion of the Salmon River highway from Hyder to the boundary-line at 13-Mile.

S. J. Schofield, of the Geological Survey of Canada, in his Summary Report recently issued, divides the ore-deposits of this section into three main types—base-metal type, silver-gold type, and gold type. The following excerpts from his report give his conclusions on each type: "The usual mode of occurrence of this type (base-metal type) is that of replacement and dissemination in certain beds of tuffs and tufaceous conglomerates, though veins occur containing the base metals. The deposits are roughly tabular, since they correspond in strike and dip with the beds with which they are associated. The minerals present in these bands are pyrite, chalcopyrite, sphalerite, and galena in a gangue of quartz. Nearly all the examples of this type occur in the *Big Missouri* ridge. The alteration or metamorphism of the rocks on the *Big Missouri* ridge makes their determination very difficult, if not impossible in many cases, so that the contact between the quartz porphyry and the tuffs was not definitely recognized, and it is certain that over the greater part of the *Big Missouri* ridge this contact is buried underneath the tuffs and the tufaceous conglomerates.

"The ores of the silver-gold type occur in veins and vein-like replacements in quartz porphyry and at the contact of the porphyry and the tuffs. The large ore-shoots are lenticular in shape. The minerals present are pyrite, chalcopyrite, sphalerite, galena, tetrahedrite, freibergite, pyrargyrite, and other sulph-antimonides and sulph-arsenides, native silver, and gold. The gangue is rather abundant and almost entirely quartz. (The *Premier* is cited as an example of this type.)

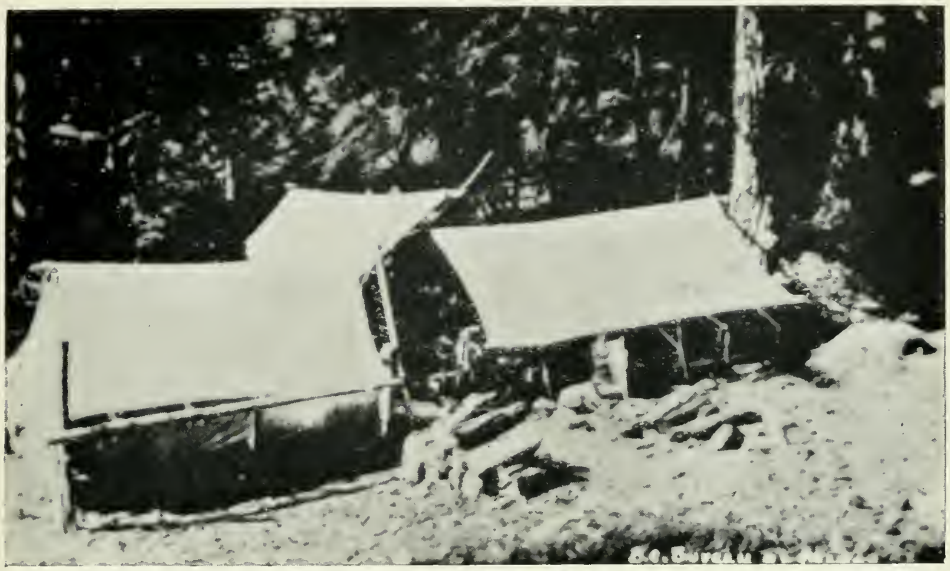
"A single ore-body in No. 2 tunnel of the *Premier* mine is of this type (gold type). This is a siliceous, heavy-sulphide deposit. Quartz and pyrite are the predominant minerals. Small quantities of chalcopyrite, sphalerite, and galena are present. Assays show high values in gold, but practically no silver.

"The ore-deposits fall into three main groups: (*a*) A low-grade, complex type, with values in the base metals, copper, lead, and zinc (*Big Missouri*, *Hercules*, *Forty-nine*, etc.); (*b*) a type rich in silver minerals, including tetrahedrite, freibergite, pyrargyrite, argentite, and in some cases native silver (*Premier*, *Silver Tip*, certain ore-bodies of the *Forty-nine*, *Big Missouri*, and *Mineral Hill*); (*c*) a pyritic siliceous type, with high gold values (an ore-body in the *Premier* mine).

"The most favourable associations for the occurrence of ore are as follows: (*a*) In the quartz porphyry; (*b*) at the contact of the quartz porphyry with the tuffs; (*c*) in certain beds of the tufaceous conglomerate.

"The slates in general do not appear favourable for the deposition of ore. The sulphides rich in silver, such as tetrahedrite, freibergite, argentite, and some of the pyrargyrite, are considered to be of primary origin and will continue in depth. The native silver is considered to be of secondary origin."

Several examinations were made during the season and two or three important deals are pending which, if successful, will mean a great deal to the development of the Salmon River section.



Premier Mine—First Camp of Discoverers, Bunting and Dilworth.

Premier Gold Mining Co.—Mill.

Premier Gold Mining Co.

This company has this year accomplished a great deal in all the departments, mining, milling, surface equipment, and transportation, and the property has now reached the stage where there should be no more serious handicaps to interfere with maximum production. With the completion of the tramway from the mine to the beach the greatest difficulties have been overcome. Mining for the year consists of extensive development-work, about 4,000 feet, on all three working-levels. On the No. 1 level, at 2,000 feet elevation, the south vein was located by diamond-drilling, crosscuts run from the No. 1 tunnel, and the south stope opened up. It shows a length on this level of about 200 feet of the same lenticular character as the north vein and with like enrichments along the fault-seams. The greater portion of the ore shipped last winter and this summer, amounting to over 4,000 tons, was taken from below the No. 1 level on the north vein and above the No. 1 level on the south vein. On the No. 2 level, 1,750 feet elevation, a long crosscut and drift picked up the south vein and the stope is now being opened up above this level. The south vein on this and No. 1 levels is supplying all the ore to the concentrator, over 100 tons a day, and considerable shipping-ore as well, found along the cross-slips. The No. 4 level, 1,325 feet elevation, has been driven ahead from the face of the old *Plate* tunnel, and at the time I was at the property (January 1st, 1922) had about 200 feet to go before it was expected to encounter the south vein. When this vein is opened up it will prove the ore-shoot to a depth of about 700 feet below the surface, and should the values hold as good as the upper levels will mean several millions of dollars' worth of probable ore. When both veins are raised on from the No. 4 level and the ore blocked out and "in sight," then a fair estimate can be made of the value of the ore. It has just been reported in the press that there are $80,000,000 worth of ore in sight, which may prove true, but is an absurd statement to make at the present stage of development.

Diamond-drilling was being done on the No. 4 level and one or two drills have been in operation all year, totalling 6,800 feet of drilling. A raise has been put through from the fourth to the second level and equipped with a hoist and cage for a thoroughfare from the No. 4 camp to the upper camp, where the main office is located.

Of the ore-bodies, S. J. Schofield says: "The ore-bodies in the *Premier* mine follow closely the contact between the quartz porphyry and the tuffs, both of which are highly altered. Up to the present no ore has been found entirely enclosed in the tuffs, but several lenses occur in the quartz porphyry. The chief locus of the ore-bodies, however, is the tuff-porphyry contact. The ore-shoots are in the form of lenticular veins, in most places about 10 feet in thickness. They have been formed partly by fissure-filling and partly by replacement of the tuff and quartz porphyry. The ore-bodies, which strike N. 75° E. and dip 70° N., are cut by several faults and shear-zones."

Surface improvements and equipment at the upper camp include new buildings for hospital; residences; bunk-house, and improvements and additions to the old ones; change-house, using open cages in which men hang their clothes, hoist them to the ceiling out of reach, and lock them when not in use, doing away with the old locker system; mine warehouse and office, etc. At No. 4 camp, at the mouth of the No. 4 or main working-level, much construction has been done and a great deal of equipment installed; a new bunk-house, with up-to-date accommodations; snow-shed; concentrator; upper terminal tramway; blacksmith-shop, equipped with machine-drill sharpener and oil-burner for heating steel; compressor building, housing two 150-horse-power Fairbanks-Morse semi-Diesel engines, compressors, lighting plant, and well-equipped machine-shop. An auxiliary consisting of two 150-horse-power Fairbanks-Morse semi-Diesel engines has also been added to the power plant.

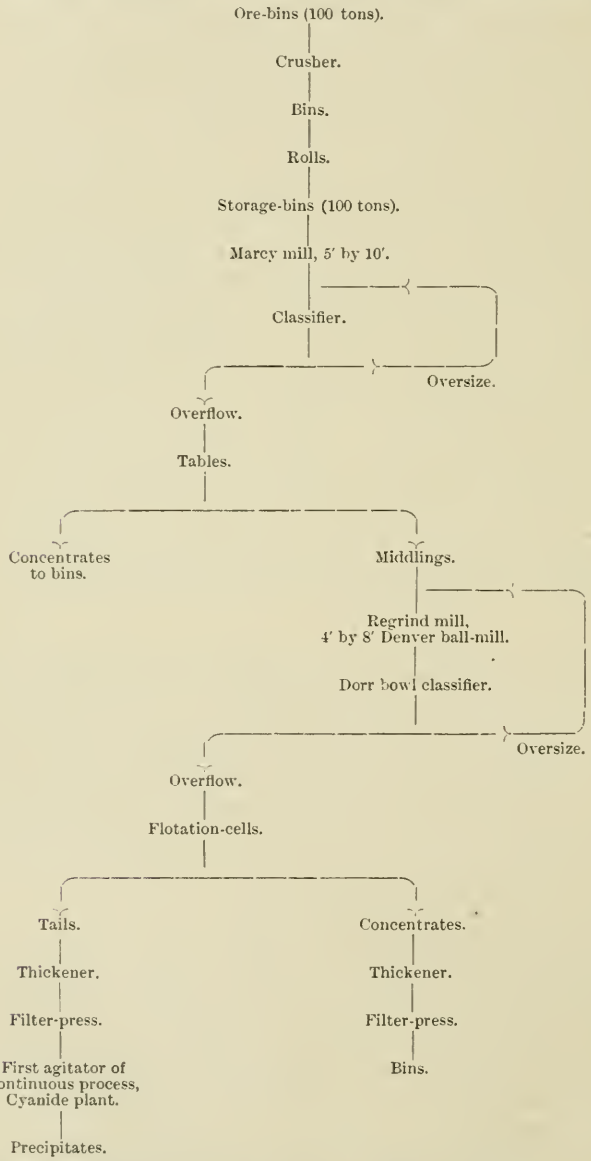
Transportation from the dock to the mine, a distance of about 15 miles, has been the greatest handicap to the development of the property. It was therefore decided to install a tramway and work was started this spring as soon as weather conditions would permit. The contract was let to the Riblet Tramway Company, Spokane, Wash., and that this company was able to complete it and have it in operation for January 1st, 1922, is a very creditable piece of work. It is 11½ miles in length, in four sections or with three angle-stations, and with a tension tower on an average of about every 4,000 feet. The difference in elevation between the upper terminal at No. 4 level of the mine and the lower terminal at the dock is about 1,325 feet. The power required to operate it is a 50-horse-power motor geared to the bull-wheel at the upper terminal. There are 153 towers in the entire distance. There are 120 buckets being used at present of 800 lb. capacity each, and as it takes less than two hours for a bucket to travel the 11½ miles,

it means a bucket dumped every two minutes, giving a capacity, at full speed, of about 12 tons an hour, which will be cut down somewhat when handling return freight.

The mill was started in July and has been running continuously, except for minor close-downs for repairs and alterations. On account of the complex nature of the mill-feed, especially its variations in silver-sulphide contents, its treatment has presented many complications and necessitated some small alterations in the mill from the original flow-sheet.

The mill was designed for treating 100 tons of feed in twenty-four hours, but has been running over capacity and producing from 20 to 30 tons of concentrates a day. The following is the present flow-sheet of the mill:—

Flow-sheet of Premier Mill, Salmon River, Portland Canal.



The ore-bunkers at the lower terminal have a capacity of 1,500 tons and are so arranged that boats are loaded directly from them by means of a travelling belt. They are housed in a three-story building 300 feet long. The lower floor on the dock-level is used as a warehouse

and storage and also contains the loading-belt. The next floor is a warehouse and the top floor is the lower terminal of the tramway and therefore the dumping and loading floor. A small hoist and incline truckway has been arranged for taking freight from the dock-level to the second or top floors. A heating plant will be installed for the double purpose of keeping perishable supplies and the ore from freezing in the bunkers.

I understand that all adjustments have been made on the tramway and that it is now working perfectly, delivering about 100 tons of ore a day. Its necessity can be appreciated when it is realized that the company has been using from forty to sixty horses and two 5-ton caterpillar tractors for hauling throughout the year, and has handled upwards of 6,000 tons of freight from the dock to the mine over the wagon-road.

The shipments from the mine this year amounted to 4,356 tons of ore, and from the concentrator 1,000 tons of concentrates and about 9,000 lb. of precipitates from the cyanide plant, the total production yielding 35,000 oz. gold and 1,200,000 oz. silver, valued at $1,400,000.

The perfected facilities for handling ore now from the mine to the dock should greatly increase shipments in the future, and will probably enable the company to ship a medium-grade ore, such as their siliceous gold ore, or ore not too high in silver values, but too good for mill-feed, to the Granby smelter at Anyox.

Credit is due the energy and efficiency of the general manager, Dale L. Pitt, and assistant manager, Bert F. Smith, for the progress made in the past two years and for the very capable organization they have built up.

The majority of the properties in the Salmon River valley have been described in previous Reports (1918, 1919, and 1920), and since there has been little development-work done this year, other than the yearly assessments, I did not make any examination beyond the *Premier*.

E. H. Bartholf and a couple of men worked on the claims of the Outland Silver Bar Mines, Limited, all summer. This company was incorporated in July, 1920, with a capitalization of $500,000, divided into 500,000 shares, with its head office in Vancouver. The company's holdings consist of six claims on the west side of Salmon glacier, about opposite the *Forty-nine* and south of the West arm of the glacier, and therefore in Schofield's "belt of dykes." The work has consisted of open-cutting and the owners report that good showings of steel galena carrying high silver and good gold values have been exposed.

Fish Creek Mining Co.

The holdings of this company consist of fifteen full claims and two fractions, situated on the Alaska side of the boundary-line, at the head of Fish creek, which empties into the Salmon river about 4 miles up from Hyder. W. Tonkin, of Seattle, is president and manager of the company and Harry Tanner has charge of operations at the property. The claims were staked about 1910 by Dan and Andy Lindeborg and acquired a year or two later by the present company. A great deal of work has been done on the different showings on the claims in the last five or six years. Three tunnels were driven on the *Olympia* claim, the lower about 100 feet long; on the *Nevada* claim, two tunnels; and on the *Starboard* claim, two tunnels.

This year's work was confined largely to the development of a well-defined vein recently discovered on the *Olympia Extension* claim, cropping on the divide between Skookum creek and Salmon river at an elevation of 3,000 feet. It strikes north-east and south-west and dips about 70° to the north-east. A number of open-cuts were put in on this vein, tracing it for about 600 feet on the surface, exposing a quartz-filled fissure mineralized with pyrite, galena, and grey-copper. The heavy galena and grey-copper carry high values in silver, the pure grey-copper assaying over 1,000 oz. to the ton. Several tons were sorted and shipped from the surface. A crosscut tunnel 140 feet long was driven, cutting the vein at about 60 feet depth and showing it to be about 7 feet wide, of which 2 feet is good shipping-ore and the balance a good-grade milling-ore.

A substantial camp was built near the portal of the tunnel at 2,825 feet elevation on the Salmon River slope, to which there is a good trail up Fish creek. Work will be continued throughout the winter, to consist of drifting both ways on the vein, sinking on the ore-shoot at the intersection of the crosscut tunnel with the vein, and the sorting, sacking, and shipping the ore that can be taken out in this work. About 20 tons was shipped during the summer and 20 tons more sacked ready to rawhide down to the wagon-road.

With the considerable tonnage of 300-oz. ore in sight and good transportation, there should be no reason why the property should not be developed into an important producer. Mr. Tonkin

informed me that it was the company's intention to install a compressor early in the spring, and a suitable concentrator, probably a flotation plant, as soon as possible.

New Alaska Group.

This property is comprised of a group of claims lying just across the Alaska-British Columbia boundary-line on the Alaska side and near 11-Mile on the Salmon River road. This group was under option for over a year to Charles Caldwell, who drove a tunnel without results sufficiently encouraging to continue. This fall the property was bonded to Pat Daly by the owners, Charles Knipple, Dan Davis, and Bill McGrew, and a small crew under Mr. Daly's supervision has been kept on development-work since.

The upper claims of the group are traversed by a broad zone of mineralized, silicified greenstone-schist of the Bear River formation. Stripping and open-cutting on this zone this fall exposed a width of about 40 feet of more pronounced mineralization, showing bunches and small lenses of galena, carrying good silver values, extending for several hundred feet along the outcrop. A tunnel was started on the north bank of a creek, cutting the zone, and in the 15 feet driven shows similar ore to that exposed on the outcrop several hundred feet away. Altogether the showing on this property is very encouraging and warrants extensive development.

Other properties on the Alaska side of the boundary-line are: The *Hoveland* group, staked and owned by J. Hoveland, of Hyder, Alaska, who has driven a tunnel 100 feet long and made numerous open-cuts and trenches on the vein, which is said to be a very persistent quartz vein, heavily iron-stained, and carrying good gold values in places. The *Riverside* group, probably better known as the *7-Mile* group, situated at 7-Mile, on the Salmon River road, is owned by Dan and Andy Lindeborg. Two tunnels, totalling over 200 feet, have been driven on a pyritized quartz vein lying in massive granite, showing considerable galena in places, the presence of which generally assuring good gold values. A small concentrating plant warranted by the ore already exposed should pay for further development, with a good chance of making a profitable small producer. The *Lucky Boy* group on Fish creek, owned by Pat Benson and associates, has had a tunnel 100 feet long driven, starting in the face of the bluff at Fish Creek falls. At about 80 feet from the portal there is a showing of 6 or 8 inches of mixed pyrite and galena showing on both walls of the tunnel. Another tunnel above the falls has been driven 12 feet and a winze sunk at the face. The *Fitzgerald* claims are said to have a promising-looking showing.

A branch trail from the Salmon River wagon-road was built up Fish creek this summer by the Alaska Road Commission.

STIKINE AND LIARD MINING DIVISIONS.

The production from these Divisions for the year was very small, amounting to about 280 oz. of placer gold.

George Adams, hydraulicking on Thibert creek, had a small clean-up on account of the immense amount of dead-work involved in removing a great mud-slide which buried his working-pit and some of his equipment. He informed me that this had been disposed of this year and that he was consequently in better shape than ever to go ahead in sluicing and cleaning bed-rock for the next two or three seasons. He is very confident that his returns will be more than satisfactory. Mr. Adams is a "sticker" and a worker and if any one can make a success of this undertaking he will.

George Adsit, on Mosquito creek, took out about 15 oz.; four men sluicing on Dease creek, about 40 oz.; three men on McDame creek, about 20 oz.; Indians on the Tahltan river and various prospectors, about 55 oz.

That interest is beginning to be taken in this extensive country is evidenced by the fact that several prospectors and scouting parties went in this year. No doubt the oil possibilities of the Northern Interior of Canada will mean the prospecting of this north-eastern part of the Province.

No lode-mining of any kind was reported for this year, either on the Stikine river or its tributary, the Iskut. At least one party was up the Iskut this year and they claimed to have traversed a well-mineralized country. Some improvement of navigation will be necessary on this river before there is any possibility of the opening-up of the section.

I reported early in the summer to the Department of Mines that I would be unable to go into these Divisions this season on account of lack of time and was instructed to send in an assistant. J. Frank Breeze, an operator in the Atlin country for several years, was procured for the trip. His report follows:—

Premier Gold Mining Co.—Dock Bunkers looking North.

Premier Gold Mining Co.—Dock Bunkers looking South.

"Pursuant to your instructions to proceed to the Cassiar District and observe and investigate mining operations and conditions there, I left Prince Rupert on July 18th for Wrangel, Alaska, arriving there on the 19th, leaving by the river-boat on July 21st for Telegraph Creek, which was reached on the afternoon of the 23rd. Arrangements were made for horses and other supplies necessary for the trip, and on July 26th we started over the trail for the head of Dease lake, where we arrived on the 30th. There is no mining along this trail, although there is evidence of placer-mining in previous years at different points along the Stikine River benches and on some of the small tributary streams. On the Tahltan river, near its junction with the Stikine, there has been work done by a couple of men this year, but it is of a very casual nature.

"From the head of Dease lake I went by Hudson's Bay scow to Porter, at the foot of the lake. I was delayed here until August 4th by lack of a boat and bad weather. While here, a party headed by H. G. Nicholls, of Vancouver, and consisting of himself, F. Watson, and W. Julian, arrived on their way to investigate petroleum indications observed a little below the junction of the Dease and Liard rivers. On August 4th we left Porter in two boats to proceed down the Dease river to Liard Post, which was reached on August 9th. At Porter I obtained the services of F. Allen, who wanted to make the trip down the river and back, and who also was interested in the oil location. The other party had the services of an Indian, who was very familiar with the river, making four in their boat and three in ours.

"The Dease river is 180 miles in length following its course and has a drop in elevation of 560 feet in its entire length. At the stage of water when we were on the river the current probably averages 4 miles an hour, but in many places in the riffles and rapids it greatly exceeds that. There are some reaches with quite slack water, notably for 10 or 12 miles above McDame creek. There are no places on the river that cannot be safely run by a boatman familiar with river-work, but a knowledge of the river and its bad places is very desirable, and some of the rapids should not be attempted for the first time without first viewing them.

"From Liard Post we went overland to a point about 15 miles south-easterly of the post to the neighbourhood where the indications of oil were said to exist. The country in this vicinity is low-lying and rolling. The general direction of the ridges, which appear to be composed of gravel, is north-easterly and would appear to be arranged by river-flow. There is very little rock outcropping, but sandstone was noticed, also shale, and some rock that has the appearance of being volcanic in origin. Quite a lot of large fragments of lime were also noted, indicating lime formation in the neighbourhood. The gravel observed was the usual river-wash and included considerable sandstone and tuff pebbles as well as granite boulders of some size.

"The formation where the indications of oil was observed, and which had been on fire and had burned continuously for about two years, appeared to be a black carbonaceous shale or impure lignite. The fire was not burning while we were on the ground.

"On August 15th I left the oil territory in company with Walter Julian, F. Allen, and T. Hankin for Liard Post, from there to return up the river. We arrived at the post that afternoon and spent the next day drying blankets and outfit, which had got wet during the continued wet weather of the past week, and preparing for a trip up the river.

"We left Liard Post on August 17th and reached Porter on September 3rd, having been seventeen days on the river, working our way up-stream every day, with the exception of two days that we laid off to dry our bedding and outfit, kept damp throughout the whole trip by the almost constant rain. The continued rains caused high water in the river, covering the beaches and making the river difficult to proceed against.

"It would seem that a reasonable expenditure of work on the Dease river would make it safer and easily navigable for small river-boats of the type now in use on the Stikine river between Wrangel and Telegraph Creek. This work would chiefly consist of shooting out some rocks in the various rapids and the straightening of some of the bends by means of shear-dams. The Hudson's Bay Company send supplies down the river from McDame and Liard Post in scows of 45 feet in length manned by crews of seven men each, loading as much as 12,000 lb. to the trip. The time consumed on the trip is from sixteen to twenty days.

"At Porter, McDame Post, and the Liard Post we saw thriving vegetable-gardens, with potatoes, carrots, beets, radishes, onions, lettuce, etc., all doing very well. At Liard Post, Frank Bass, the post manager, has a very flourishing garden and we had some excellent new potatoes as well as other garden-stuff. The two or three light frosts experienced during the

trip did not do the gardens any apparent harm, and along the valley of the Dease there are long stretches of river-bottom that might return good crops if cultivated.

"Below McDame creek the valley of the Dease widens and the river also gains in size. High cut-banks of gravel, sand, clay, etc., of considerable extent appear and the river's course is interrupted by frequent bars forming sloughs and cut-offs. Farther down-stream the banks become generally lower and the hills are farther back from the river and extensive flats and bars are formed. Any of the bars will apparently give a prospect of fine gold to the pan, and some of the bars cover considerable area, so great that if on prospecting them the values are sufficient and consistent they would make workable propositions for dredging. The gold, while fine, is not flaky, but under a glass appears to be shotty or heavy in character. The depth to the bed-rock, which is generally a shale in this locality, does not appear to be great, as it frequently outcrops along the shore and in the stream-bed, helping to form the numerous riffles encountered in the course of the river.

"*McDame Creek.*—When I visited this creek there was no work being done, the only persons who had been doing anything this year—Wing *et al.*—having discontinued operations for the year, but I am informed that they will resume next spring.

"*Haskin's Mountain.*—This mountain is reached via McDame creek. A number of mineral claims were held on it for some years, but there is no actual development being done. Mr. Brindle, who represents some interested parties, and whom I met at Porter on his way out of the country after spending the summer investigating the properties, expressed himself as being satisfied with the results of his work.

"*Thibert Creek.*—This creek flows into Dease river from the west, just where Dease river flows out of Dease lake. The principal operations are those conducted by George Adams on the property lately held by the Dease Lake Syndicate and established by the late Warburton Pike. The property comprises a number of leases that cover between 3 and 4 miles of the benches of the creek, through which an old channel runs, at an elevation of about 100 feet above the present creek. The rock formation in this neighbourhood is chiefly magnesium rocks and the bed-rock of the pit being worked this summer is largely serpentine. Mr. Adams's work was much hampered and set back by a great slide of overburden that necessitated the removal of his plant and a new set-up. Then he had to pipe away a great deal of the slide to get to the face of the pit, so that it was not until well into August that he had any pit-room or got back to virgin ground to the face. The ground he was working at the time of my visit was prospecting very satisfactorily and Mr. Adams expressed himself as very much pleased with the outlook.

"While the slide, which broke far up the hillside and filled his workings and overran to the creek below, occasioned him considerable delay and expense, he estimates that he will later be benefited by it, for at the present rate of progress, he will have at least two years' work in ground from which the most of the overburden has been removed by the slide, consequently saving him the expense and time required to otherwise move it.

"It is his intention to increase his water-supply by taking water from Thibert creek, which has an ample and unfailing flow. He is now looking into the matter of materials, etc. The transportation question for this undertaking is a serious one at this point, the pack-train being the only means of obtaining supplies or equipment from Telegraph Creek to the head of Dease lake, a distance of 75 miles.

"Mr. Adams has traced the old high channel along the south side of Thibert creek from Berry creek, where his present workings are located, for a distance of about 3 miles down-stream. Thibert creek was pretty thoroughly worked in the early days and the best 'pay' found where the old high channel had been broken down or cut through by smaller streams and the gold from it concentrated in the present creek-bed. There is every reason to believe that the old channel thus contributed to values that made mining profitable on Thibert creek in those early days.

"*Deloire Creek.*—This creek enters Thibert creek from the south, about 3 miles from its mouth, and is a steep creek with a good flow of water. Work was done on this creek this year by the Noonan Bros., but was discontinued early in the summer. They were endeavouring to locate the continuation of the pay-channel that was successfully worked for some years. They sunk a shaft and also operated an Empire drill in an effort to determine the depth to bed-rock to guide them in bringing up a drain that would take care of the flow of water on the ground.

This work is to be resumed in the spring by others who have a working arrangement with the owners. It is a likely location and merits prospecting.

"*Mosquito Creek.*—This is a small creek flowing into Thibert creek from the north, about 13 miles from the mouth. The only work being done is a tunnel that is being driven by George Adsit, who has worked the ground by means of open-cuts for some years, but who is now trying to follow the 'pay' on bed-rock under the present creek-bed. Being immediately under the flow of the present creek, the drift is very wet and he is working at considerable disadvantage. He claims that the ground in the face prospects very well, and some panning that I did while there returned a few grains of nice-looking shot gold.

"*Dease Creek.*—Dease creek enters Dease lake from the west, about 8 miles from the foot of the lake. It has an ample supply of water, maintaining a flow of probably 5,000 miners' inches on a steep grade. The bed of the creek and the lower bars were worked in the early days and considerable drift-mining was carried on in the working of the older river-channel, which follows chiefly the south side of the present creek, at an elevation of about 150 feet above it.

"About 3 miles up the stream from the outlet Tom Ryan is endeavouring to tap the old high channel by means of an open-cut, using a boomer and a hose-line. He is still on the rim-rock, but has some good-looking gravel coming in in the face of the cut. He reports good prospects and hopes to get through to the channel next summer. He is preparing to run a tunnel into the ground this winter at a point where he has good prospects of obtaining fair 'pay.'

"Adjoining him, Philip Hankin is running a tunnel to get into the same channel. His tunnel is still in the rim-rock, but he expects to get through it in another 30 or 40 feet. Three miles farther up the creek and about 6 miles from the mouth, Mr. Johnson is drift-mining and says that he meets with varying success. He had two men employed in the early summer, but is now working alone. This constitutes all the operations on Dease creek at present. The flats at the mouth of the creek were prospected by drilling a few years ago, and, while satisfactory values were said to have been obtained, the work was discontinued on account of the war and has not since been resumed.

"Investigation might prove the old high channel on Dease creek worthy of equipment to work it, for where it was possible to work it by drifting the returns are reported to have been good, and from the amount of work that was done it is evident that the miners met with encouragement."

ATLIN MINING DIVISION.

The placer yield has been practically the same as last year, about $138,500, and may be expected to average about the same for some years to come, unless new diggings are found, as there is little chance of any of the working creeks increasing their present outputs to any extent. Spruce creek with an output of $50,000 and Ruby creek with $47,000 are the leading producers in the Division, and with Pine and Otter creeks, producing about $12,500 each, and Boulder creek, producing $3,600, make up the bulk of the yield for 1921. The event of the season was the finding of a 40-oz. nugget on Ruby creek.

Lode-mining has at last shown some signs of activity, especially in the Rainy Hollow section, where the *Maid of Erin* property is undergoing development.

In the Atlin section also, the Fourth of July creek properties have received some attention this year and deserve more. The *Engineer* mine has still got the most prominent ear-mark of a valuable mine—litigation. It is unfortunate that the progress, not only of the property itself, but probably the whole section, must thus be retarded.

Rainy Hollow Section.

This section is the drainage-basin of the Klehini river, a tributary of the Chilkat river, which flows into Chilkat inlet north-west of Haines, Alaska. The area is reached by way of Haines, a port of call for American boats, but not for the Canadian Pacific Railway boats, which go on through to Skagway, about 15 miles farther. From Haines there is a good motor-road for 24 miles to Wells camp; from there is a fair wagon-road through to the foot of Mineral mountain, on which the mine is situated, a further distance of 32 miles, of which the last 12 miles is in British Columbia.

The Alaska Road Commission expended $40,000 last year and $25,000 this year in rebuilding the road from Haines to Wells, building a bridge across the Chilkat river about a half a mile above Wells, and continuing the road for a mile or two above the bridge. They expect to finish through to Pleasant camp, at the International Boundary, next season. The road from Pleasant camp to the mine had some badly needed repairs made on it this year by Mr. Wiley, who is operating in Rainy Hollow. This portion of the road requires at least $5,000 more spent on it as early next year as possible.

The bridge built by the Alaska Commission above the forks of the Klehini and Chilkat rivers is 900 feet long and has a width of 11 feet between the guard-rails. The bents are 15-foot centres, of four piles each driven 15 feet in the gravel, on which are five stringers for the decking of 4-inch plank. It is certainly a very substantial structure and, as there is practically no driftwood in the Chilkat river, the short spans are not a fault.

The old road was on the south side of the Klehini and had the double disadvantage of being late in clearing of snow in the spring and necessitating recrossing the Klehini below Pleasant camp; however, it served the Porcupine and Glacier Creek placer camps. The new road has been cruised up the north side of the Klehini all the way, practically following the old Dalton trail, and will be a first-class truck-road from the boundary-line to Haines when completed.

The only property which is being developed to any extent is the *Maid of Erin* group, which is under bond to Robert Wiley, of Seattle, and who started work in June, 1920. For a previous description of the property the reader is referred to 1918 Report, page 86.

There are thirteen claims in the group, situated on Mineral mountain, 58 miles from Haines, and owned by Conway, Kennedy & Burnham, of Skagway, Alaska. The owners had done considerable development-work and made some small shipments.

Mineral mountain consists of broad belts of limestone, slate, and sandstone in places metamorphosed to quartzite, the whole apparently underlain by granite, which forms the western border of the sedimentaries and shows a little lower on the hillside. Directly in contact with the granodiorite is a belt of crystalline limestone from 300 to 400 feet wide intruded by spurs from the main granite range.

Along the granite there is a belt of crystalline limestone in which there are several veins roughly paralleling each other and the granite. The most important of these, so far, is about 250 feet east of the granite-limestone contact and consists of a vein of contact-metamorphic type, about 12 feet in width, composed of from 1 to 5 feet of a mixture of solid bornite and chalcocite lying on the limestone foot-wall; the balance of the vein is garnetite, quartz, and some calcite, disseminated with bornite and grading out into the limestone hanging-wall.

The vein dips into the hill away from the granite at about 22°. There are several outcrops below this, indicating other veins and mineralizations of the same type. No work has been done on these showings yet. The granite-limestone contact is at least 400 feet vertically lower than the outcrop of the upper vein, indicating that considerable depth may be expected to the veins.

An incline shaft has been sunk on the main vein, following the limestone foot-wall, a depth of 160 feet (in the middle of July), exposing from 1 to 5 feet of solid bornite and chalcocite all the way down. I understand that the shaft was continued to over 200 feet depth with good ore all the way, though rather broken up at the bottom. Drifts are being run both ways from the bottom of the shaft and are opening up a fine shoot of ore. Mr. Wiley is very pleased with the results of development so far. He was able to get out only 55 tons before winter set in, assaying 25 per cent. copper and 32 oz. silver to the ton. The property has all the appearance of developing a big tonnage of high-grade copper ore. With the amount of milling-ore indicated in the main vein and what may be expected when the lower veins are opened up, it looks as if it would make a big milling proposition. Given good transportation in the shape of a first-class truck-road, this property should make a valuable producer.

Mr. Wiley has attacked the undertaking in a very aggressive manner, and has not only done a lot of prospecting and development work, taken out and sacked several hundred tons of ore ready for shipment, and built a 3-mile tractor-road from the end of the Government road up to the mine, but has also expended a large amount of money on equipment. This consists of two 15-ton Holt caterpillar tractors, each of 120 horse-power, with 4 trailers, one 5-ton, one 3-ton, and two 2-ton capacity; a small Cleveland tractor; a portable air-compressor of 210 cubic feet of air a minute capacity; and two jack-hammers for development-work. In addition, there are two 5-ton Holt caterpillar tractors and five 5-ton trailers on order.

The big tractors and heavy trailers are for use on the road from Haines to Wells or farther as the Alaska road is completed, and will easily handle 40 tons each of freight in and ore out. The 5-ton tractors will be used from the end of the Government road at the foot of the hill as far down as found feasible, to supply the big tractors with ore and, of course, take freight back. The Cleveland tractor is used on the hill for hauling ore from the mine down to the Government road. The portable compressor was taken up to the mine early in the summer and was in operation the balance of the season.

Altogether, Mr. Wiley had invested about $125,000 in the undertaking by the middle of July, and at that time figured on getting out several hundred tons of ore during the fall. He estimates that he can deliver ore from the mine to Haines, 58 miles, for not to exceed $10 a ton with a first-class road.

The opening-up of this property and putting it on a shipping basis means everything to the Rainy Hollow section and for 40 miles beyond, to the Yukon boundary, which is said to be a well-mineralized country, but, of course, inaccessible so far as lode-mining is concerned. Every assistance should be given in putting the road on the British Columbia side in good hauling condition.

Saucier & Goddard, of Haines, have some claims across the Klehini river a few miles from Pleasant camp, on which there is said to be a fair-looking quartz vein, carrying free gold, in massive granite formation. A Mr. Silverman examined the property this summer and appeared well pleased with it.

Atlin Section.

Big Horn Group.

This group consists of six mineral claims—*Big Horn*, *Little Bear*, *Gold Bird*, *Lucky Jack*, *Tyee*, and *Bertha*—owned by Fred Lawson and associates. The claims are situated up Big Horn creek, about 10 miles by trail from Taku arm of Tagish lake. Mr. Lawson's cabin is on the west side of the arm just opposite Golden Gate. The *Engineer* mine is a few miles farther down the lake and on the opposite side. The trail from Lawson's cabin skirts around the lake to Otter creek, which it follows up about 3 miles to Big Horn creek, which empties into Otter. It then follows up Big Horn creek to the camp at the property. The camp is at an elevation 2,550 feet, or only 400 feet above the lake, and the trail therefore has little grade and could be converted into a wagon-road at comparatively small expense.

The showing on the claims is a small flat quartz vein occupying a shear-zone in hornblende-schist formation overlying a gneissoid granite. The shear is about 2 feet wide and filled with ground-up schist, in which the fissure-filling of quartz is from a few inches up to the full 2 feet in width. The quartz carries small amounts of pyrite, galena, and native gold.

At 3,390 feet elevation a tunnel has been driven on the vein for about 50 feet. At the face the vein is about 6 inches wide and looks as if it were turning down on a dip of about 30°. A sample at the face gave low values in gold and silver. About 40 feet north of this another tunnel has been driven about 54 feet, following the vein for about 6 feet, when it cut out, but again appeared about 10 feet back from the face. Older barren veins of quartz are also found in the shear-zone. The quartz lens on which the tunnels have been driven appears to pinch out just north of the last tunnel. There is about 30 tons of ore on the dump from these two tunnels ready to be taken down to the mill at the cabin. The vein can be followed along the face of the bluff for 200 feet south of the first tunnel. It has been open-cut for about 100 feet of that distance, from which some fine ore was taken. A grab sample of the broken ore along the cut gave 23.9 oz. gold and 3 oz. silver to the ton. This is the largest quartz lens seen on the claim, though there are many small ones, bunches and blocks, in the broken-up distorted schistose-rock formation.

A light-coloured quartz or granite-porphyry dyke striking N. 10° W. (mag.) was followed from the quartz vein to the top of the hill, at 5,425 feet elevation. In this several lenses of quartz were noted, paralleling the strike of the dyke, but as no work had been done on any of them no samples were taken. Values of $18 a ton are said to have been obtained on the croppings.

Mr. Lawson has rigged up a tramway with a heavy wire from the tunnel levels to the foot of the hill. Ore is let down in a single bucket with a light cable running on a braked windlass, used for pulling the bucket back. The mill consists of a sample crusher and one stamp operated by an overshot water-wheel. No ore is sent down the hill that does not show free

gold, the feed assaying up to 14 oz. gold to the ton and the sulphide concentrates running up to 90 oz. gold to the ton. A grab sample from a small dump at the camp that has been sorted over several times gave $14 a ton in gold.

The showings on the property are too limited to warrant any large operations, but three or four men might make the lens pay, the work on which is being done.

Spokane Group.

This group consists of three claims—*Spokane*, owned by Mrs. A. Lawson; *Mohawk*, by Horace Fraser; and *Edwin*, by Jules Eggert, of Atlin, B.C.—and is situated about a mile north of the *Big Horn* group. Considerable work has been done on the property, consisting of three tunnels. The highest, at 4,275 feet elevation, is in about 12 feet, with a 15-foot open-cut at the collar. The work shows a 2-foot vein of quartz, sparingly mineralized with disseminated iron sulphides, lying in a schistose country-rock. The vein strikes S. 60° W. (mag.) into the hill and stands about perpendicularly. A grab sample taken from about 20 tons of quartz on the dump gave returns of 0.76 oz. gold and 0.4 oz. silver to the ton.

The next tunnel, called the "blacksmith tunnel," is at 3,750 feet elevation. It was driven 30 feet to the vein and the vein crosscut, showing a width of 10 feet of quartz slightly mineralized with grains of marcasite. At 3,375 feet elevation the vein again crops, showing 4 feet of quartz. A tunnel was driven here for a distance of 125 feet, but bears away from the vein. The mouth of the tunnel had caved and was therefore impossible to get into it, but I suppose the idea was to drive alongside the vein in the softer country-rock. Altogether, this is a rather promising-looking vein. It is very persistent and if the quartz averaged from $15 to $20 a ton it would make a profitable little property.

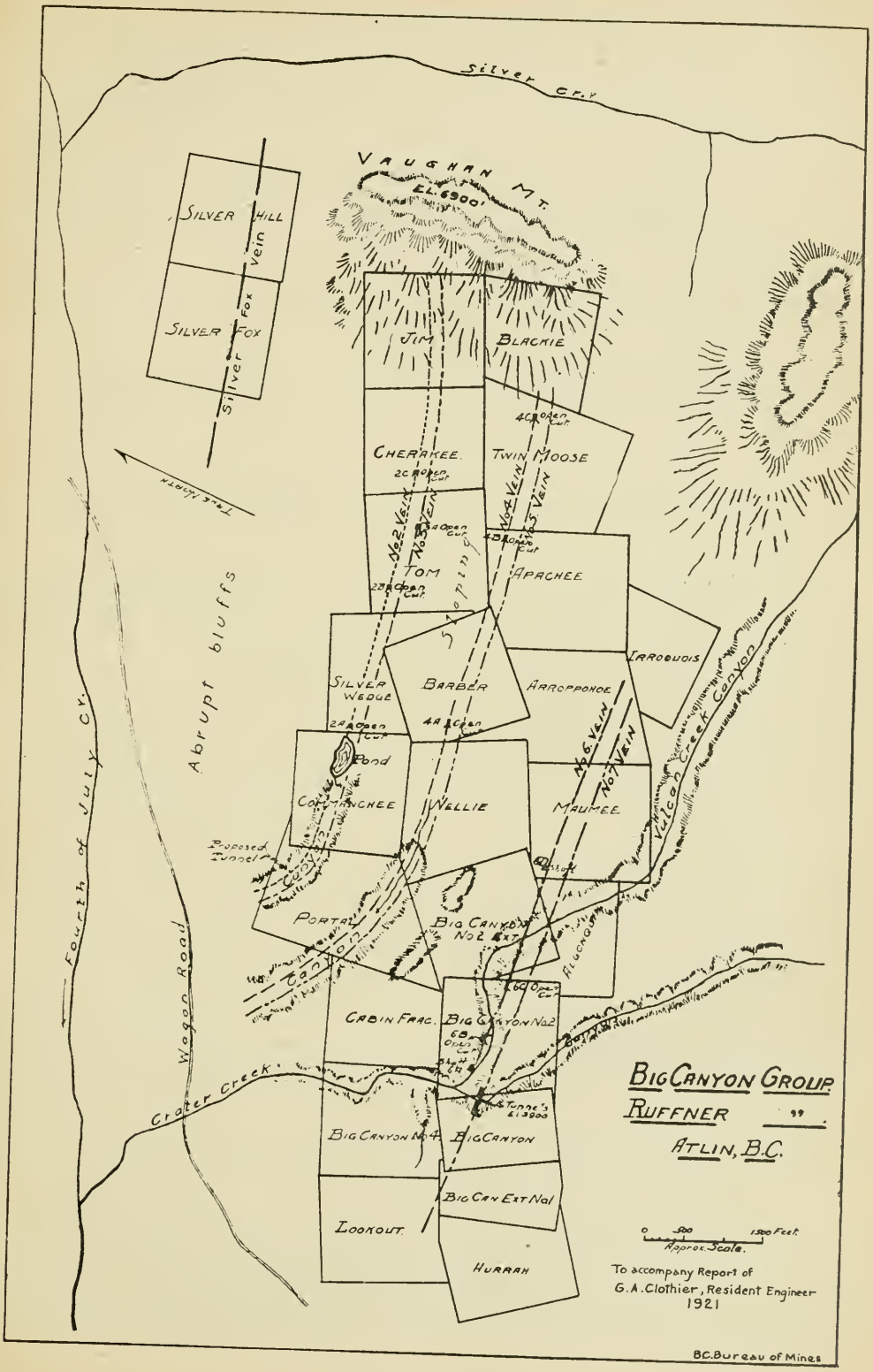
Big Canyon and Ruffner Groups.

(*See* accompanying sketch.) These two groups include altogether twenty-five mineral claims, twelve in the *Big Canyon* group and thirteen in the *Ruffner* group. The former is under option to Mr. Ruffner, of Atlin, B.C., who staked the balance of the ground contained in the *Ruffner* group. The claims are situated on Vaughan mountain, about 10 miles up Fourth of July creek from Atlin lake. From Atlin it is about 14 miles by wagon-road, the first 6 miles of which is in good repair; the last 8 miles, up the creek, is in fair condition, but has not had sufficient work on it to make a good road. Transportation, however, would not present any serious difficulties, for an easy-grade motor-truck road could be built from the lake to the foot of the hill, on which the claims lie, at a comparatively small cost. There is a fine bottom for a road, no rock-work, and very little grading would be needed if the road route were carefully selected. The difference in elevation between Atlin lake and the foot of the hill, 10 miles, is about 1,000 feet, and from the foot of the hill to the present camp is about 750 feet. The valley is well timbered and I judge that plenty of water-power could be developed in Fourth of July creek.

The prevailing rock formation of Vaughan mountain is light-coloured coarse-grained granite. This has been intruded by many dark-green andesitic dykes which have followed a roughly parallel series of fractures in the granite, striking N. 30° to 50° E. and dipping at a high angle to the north-west. The dykes have evidently also formed lines of weakness, for they have been intensely sheared and crushed by subsequent movements. Mineral-bearing solutions following along these shear-zones have filled the fissures, replaced the crushed dyke-rock to a great extent, and cemented the rock fragments with quartz, calcite, and the metallic minerals, arsenopyrite, zinc-blende, galena, pyrite, and chalcopyrite, in importance of probably the order named. The veins are therefore mineralized dykes.

Owing to the loose ground-up nature of the vein-filling intense weathering and oxidization have taken place, and the surface showings are consequently nothing more than residual limonite and sand, with ribs of mineralized quartz in it. This surface oxidization has penetrated to such a depth that none of the surface work yet done on the showings has got into the solid vein-filling beneath.

On the lower claims, or the *Big Canyon* group, two big veins or mineralized dykes crop very prominently and considerable work has been done on them. The upper of these veins, called the No. 7, cuts across Crater creek, about 300 feet south of the forks of Crater and Vulcan creeks. The canyon exposes it to considerable depth, showing it to be from 25 to 30 feet wide and striking N. 50° E. (mag.) The hanging-wall portion of the vein for a width of 8 or 10 feet is brecciated quartz and dyke-rock, very slightly mineralized and gradually becoming


Silver Cr.
VAUGHAN MT.
EL. 6900'
SILVER HILL
Vein
SILVER FOX
Silver Fox
JIM
BLACKIE
CHEROKEE
TWIN MOOSE
TOM
APACHEE
IROQUOIS
SILVER WEDGE
BARBER
ARROWHEAD
Pond
COMANCHEE
WELLIE
MAUMEE
Proposed Tunnel
PORTAL
BIG CANYON No2 EXT.
CABIN FRAC.
BIG CANYON No2
BIG CANYON No4
BIG CANYON
BIG CAN EXT No1
LOOKOUT
HURRAH
Abrupt bluffs
Fourth of July Cr.
Wagon Road
Crater Creek
Vulcan Creek Canyon
BIG CANYON GROUP
RUFFNER
ATLIN, B.C.
0 500 1500 Feet
Approx. Scale.
To accompany Report of
G.A. Clothier, Resident Engineer
1921
BC. Bureau of Mines

more quartzose toward the centre of the vein. The central part is the best mineralized, while the foot-wall is practically straight dyke-rock. At an elevation of 3,900 feet a tunnel has been driven 170 feet, following the ore, which occurs in parallel bands, bunches, and small veinlets. At about 100 feet in the tunnel a lens of ore about 6 feet wide and lying about the centre of the dyke was followed for about 30 feet, where it cut off abruptly, probably thrown to either of the walls. Several tons of ore from the tunnel and an open-cut above was sorted and sacked, samples of which averaged about 27 per cent. lead and 50 oz. silver to the ton. The silver values vary from 1 to 3 oz. a unit of lead; samples of galena assaying 50 per cent. lead run as high as 140 oz. silver and $16 in gold to the ton. A conservative independent sampling of the tunnel gave an average of 11.4 oz. silver to the ton across 6 feet for a length of 70 feet. A tunnel was driven 70 feet on the same vein on the opposite side of the creek, showing about the same conditions.

The lower of these two veins, No. 6, lies just below the forks of Crater creek, follows the north bank of Vulcan creek for several hundred feet before crossing to the south side, and is believed to again crop on the *Maumee* claim, 3,000 feet farther up the hill. The work on the lower end of this vein consists of a shaft 10 feet deep and a couple of shallow open-cuts, exposing an intensely oxidized vein from 8 to 12 feet in width. It strikes N. 40° E. (mag.) and dips about 70° to the north-west. The elevation of the shaft and cuts is about 4,000 feet. This dyke is not as wide as the upper one, but the whole is mineralized between the granite walls, giving it more the appearance of a fissure-vein. Two samplings of the shaft gave an average of 15 oz. silver to the ton across 6 feet. The gold values are small, running up to $4 a ton. This is a strong, well-defined vein, traceable for two claim-lengths, carrying fair values in the surface oxides, and is certainly worth gaining sufficient depth to prove it below the zone of oxidization.

Farther up the hill at an elevation of 4,600 feet, on the *Maumee* claim, what appears to be the continuation of the No. 6 claim has been exposed by a shaft about 10 feet deep. An average of different, reliable samplings of the shaft and adjacent open-cuts indicate a value of about 15 oz. silver to the ton for a width of about 5 feet. The vein strikes N. 40° E. (mag.) and stands almost perpendicularly. It is 6 feet wide, between solid granite walls, and composed of siliceous dyke-rock mineralized with arsenopyrite, zinc-blende, and galena.

From this shaft north across the face of the mountain four other veins have been found in a distance of about 3,500 feet, having the same appearance and characteristics as the two already mentioned. No. 5 vein is indicated on the surface, but no work has been done on it yet.

On No. 4 vein, at an elevation of 4,975 feet, an open-cut and tunnel of about 40 feet, shown on the sketch as 4A, expose a vein about 8 feet wide at the portal of the tunnel, where it is intensely oxidized. The face of the tunnel is becoming a little more solid, ribs of mineralized quartz appearing. A sample across 4 feet at the face gave assays of $1.60 gold, 27.2 oz. silver, and 6.5 per cent. lead. Another open-cut, 4B, 200 feet farther east on this vein and at 5,500 feet elevation, shows from 4 to 6 feet of oxidized material. In this is a vein of about a foot of good ore. A sample across 8 inches of it gave 43.2 oz. silver and 2.1 per cent. lead to the ton. The oxides assay between 3 and 4 oz. silver to the ton. Another sampling of cut 4B gave an average for five samples of $3.95 gold and 16.1 oz. silver to the ton across 3 feet. There is another cut higher up on the same vein, proving it for a length of over 4,000 feet. The clean galena in this vein assays well in silver, 42 per cent. lead carrying 162 oz. silver, suggesting grey-copper or silver sulphides, though none were noted. Though depth will be gained very slowly for a way in driving the tunnel at showing 4A, I think the values found in the solid sulphides fully warrant the continuation of this tunnel far enough to get in beyond the oxidization.

Some 1,500 feet north of this is No. 3 vein. The only work done on it is one open-cut, showing a foot of ore in the bottom of the cut, assaying 30.4 oz. silver to the ton.

Still farther north, No. 2 vein has been exposed in several places and demonstrated to extend for a length of at least three claims, or 4,500 feet. One of the open-cuts, 2C, at an elevation 5,575 feet, has been driven on the vein about 25 feet and shows it to be at least 14 feet in width, and consists of soft oxidized material in which are found chunks and badly decomposed seams of solid coarse-grained galena. The clean galena is said to assay over 200 oz. silver to the ton. Down the hill from this, another cut, 2B, assayed $1.20 gold and 50.8 oz. silver to the ton across 24 inches of ore. No. 2 is one of the best-looking veins on the property.

It can be seen following a depression from the top of the mountain to below showing 2B, from which point the ground flattens out to a point below the pond and showing 2A, where it again breaks off abruptly and the vein is distinctly marked by a deep ravine to the bottom of the hill. The point, being at a low elevation, would be a very advantageous place from which to attack the property for extensive operations. By driving a short crosscut tunnel to No. 2 vein and drifting on it, crosscuts could then be driven to intersect the other veins at great depth.

However, there is a great deal of surface development-work to be done before deep development is attempted. The property is seriously handicapped in having such a depth of oxidization on the surface of the veins, but, taking everything into consideration—the number of veins already found, their widths and continuity, and their surface values—I think there is every chance of developing at depth a tonnage of commercial ore that will make this a valuable property. Judging from the values in the sulphides found in the surface, it is certain that the galena will pay to ship, and it may prove that a concentrate of all the sulphides will be of shipping grade.

In my opinion, the property fully warrants the expenditures necessary to drift on the No. 2 and No. 4 veins a sufficient distance to penetrate the zone of oxidization and demonstrate the extent and values of the sulphides in the solid gangue.

Ruby Creek.

This creek was first worked by hydraulicking in 1912, since which time it has probably been the best paying of the smaller creeks in the Atlin district. Records extending over that time show that the gravel has averaged over $1 a yard and bed-rock from $1 to $2 to the square foot. Up to and including 1920, approximately $400,000 has been taken out of this creek by the one operating company. The yearly clean-up has ranged from $30,000 to $80,000 in that time, and about three-quarters of a mile of bed-rock, averaging about 200 feet in width, has been cleaned. A nugget valued at over $700 was found this year.

The company in working up the creek encountered lava along the rim in several places, the flow over the creek-bed evidently having been so thin that it was broken up and carried out with the high water. This basalt flow did not interfere with operations until the fall of 1918, and in the following year it was found necessary to move the plant farther up the creek. I judge that the company has now about 1,000 feet of open creek to the heavy lava-bed above and the limit of its ground. Above the company ground 1,500 feet is held by Roxborough, of Atlin; then 500 feet by the company; then 200 feet by Colbourne; then a mile by Chas. Miller, a mile by Krumbeigle, and above that by various owners.

I see no reason for drawing any other conclusion than that the pay-streak, so thoroughly proven down the creek, continues on up the old channel, which no doubt formed a natural channel for the lava-flow. Judging by the amount of gold that has been taken from the creek below, drift-mining under the lava on the same channel should be profitable if mining conditions are favourable. At any rate, it is well worth investigating, for I am informed that the old channel has never been prospected here. A shaft was pointed out to me on the bank of the present creek and along the edge of the lava-flow which was claimed to be down 20 feet and to have struck encouraging values on the rim of the old creek-bed.

It would not be a very expensive undertaking to sink a shaft to the rim and from there an incline to bed-rock under the lava, from which point drifting operations could be carried on. Pumping might be expensive for a time, but would be dispensed with when the drift on bed-rock had reached the elevation of the top of the shaft.

At the time I was on the creek this summer, July 8th, Krumbeigle and partners were sinking a shaft on their lease trying to penetrate the lava. The shaft was down 40 feet then and still in the solid basalt when work was suspended this fall.

Boulder Creek.

The upper leases on Boulder creek are held by Chicago interests, with Mr. Gore in charge of operations. The great handicap on this creek has always been the lack of water. This year a new dam 150 feet long was built across the creek at an elevation of 4,100 feet. This forms a reservoir which when full will operate two giants about three hours, against twenty minutes

for one giant before. The pressure-box is about half-way between the dam and the pit, from which there is a pipe-line from 40 inches at the box to 12 inches at the machine, with a head of 120 feet. A pipe-line from the dam to the pit would give a 200-foot head. A clean-up was made from a small pit while I was there, yielding $1,000. Considerable dead-work has been done since that time in preparation for further operations.

Otter Creek.

The Mines d'Otter Creek, under the management of Henri Maluin, has been operating on this creek for several years, sluicing out in that time a channel probably a mile long, from Surprise lake to the present face. In all this work there has been no "pay" to amount to anything, with the exception of a couple of small flat benches high up on rim-rock which gave good returns. No bed-rock has ever been found. This year's operations have been the most encouraging so far, and it looks as if the rims were converging and consequently some chance of reaching bed-rock. In addition to this, "pay" was found on the right-hand side of the creek, looking up, on a higher rim, which increased the season's yield and gives promise of further "pay," as well as better results expected on bed-rock in the near future.

Mr. Maluin and the company he represents are certainly "stayers" and are deserving of every success.

O'Donnel Creek.

There has been no production from this creek to amount to anything for the past several years. This year there were three men working at different places on the north banks, trying to get under a deposit of blue clay, under which the old workings had good "pay." It looks as if there had been a slide, or a deposit of blue clay over an old channel, but whether the clay has crowded the gravel out of the old channel entirely and over the rim of the present channel, or whether the clay has simply covered the gravel in the old channel, is the information wanted.

See J. A. Fraser's report on the Atlin Division following this report.

In concluding this report, I wish to express my appreciation of the courtesy and assistance of the prospectors and operators throughout the district.

CASSIAR DISTRICT.

ATLIN MINING DIVISION.

Report by J. A. Fraser, Gold Commissioner.

I have the honour to submit my report on mining operations in the Atlin Mining Division of Cassiar District for the year ending December 31st, 1921.

I regret having to report another season of limited operations and output; this was due to the small number of men engaged in actual mining, the large percentage of whom were engaged in prospecting new ground or in doing dead-work of a prospecting nature.

There was a smaller number of people in the district this year (not counting tourists) than ever before, and of those who were here not more than 130 were engaged in placer-mining at any time, and of those at least twenty were prospecting new ground in one form or other.

Not more than forty men were engaged at any time in quartz-mining, and of those from twelve to fifteen were prospecting and doing assessment-work.

I have not been able to secure as full returns of output as in former years, but, while apparently there was a little less output than in 1920, the amount *per capita* is quite up to that of last year, and the revenue collected will be about the same or possibly a little more.

The output on Ruby and Otter creeks exceeded that of last year; that on Spruce creek was about the same, but the production on the other creeks was less.

Taking the creeks in the same order as for some years past, I may say that on McKee creek the prospecting operations initiated a year ago by the Delta Gold Mines Company have been carried on throughout this year, but only on a small scale. They are still in progress. The company has located some more leases adjacent to those already held, which seems to indicate the intention of activity in the near future, but as the company's executive lives in Pittsburgh, Pa., I have not learned as yet just what is contemplated, or when.

On Pine creek from ten to fifteen men operated throughout the season from May to the end of October, with very fair returns in most cases for the time actually employed in mining. A few men are drifting on this creek this winter.

On Spruce creek from thirty-five to forty-five men were operating throughout the season and a number are drift-mining there this winter. From eight to twelve of the above number were prospecting during the greater part of the season, but those who were sluicing recovered in most cases very good returns. This was still the banner creek from the standpoint of production, having supplied about $50,000 of the total output of the camp.

On Birch creek a small force operated for a portion of the season with rather indifferent success, but next season will find them at work again.

On Boulder creek from eight to twelve men operated from May to October 4th, when operations were suspended for the season. A considerable portion of the time above mentioned was spent in working through comparatively barren ground to reach much more promising ground farther back from the creek, where next season's operations are expected to compensate for the dead-work done this year. Owing to an unfortunate condition created by the spring freshet the operators on the lower portions of the creek did practically no mining throughout the season.

On Ruby creek the Placer Gold Mines Company, under the joint management of C. E. Leonard and C. H. Titus, commenced operation on April 24th and continued until October 14th, during which period they advanced up-stream over 400 feet, with an average width of 160 feet, and moved about 45,000 cubic yards of gravel, from which they recovered about double the output of 1920 and incidentally secured a handsome profit upon the season's operations. The company had been doing more or less dead-work for two seasons past and is now realizing the benefit thereof. A force of about twelve men was employed throughout the season. This company suffered a sad loss through the death last winter of Theo M. Daulton, who installed the plant of this company and had been its manager since its formation. The camp is also the loser through the passing of this genial and highly esteemed gentleman from the ranks of the operators therein.

A number of men were prospecting on the higher reaches of this creek throughout the summer and from eight to ten are "drifting" there this winter.

On Wright creek four or five men were mining throughout the season, but I regret to say I have not had any report as to the amount of work done or as to results therefrom.

On lower Otter creek the Mines d'Otter, under the superintendence of Henri Maluin, with J. E. Moran as foreman, commenced operations on April 25th and continued until the end of October, during which period they advanced their sluices up-stream about 250 feet and moved about 200,000 cubic yards of material, but have not yet reached bed-rock, for which they are searching. This season's operations uncovered about 40,000 square feet of a hard-pan bed-rock, such as has been described in previous reports, but no satisfactory amount of gold was found thereon. Near the close of the season, however, a discovery of a stratum or deposit of really good pay-gravel on a somewhat high rim increased the season's output very materially, exceeding last year's output by from 20 to 25 per cent., and encouraging the belief that good "pay" may be recovered from rather high levels in the benches, as well as from bed-rock when they reach it. A few men are drift-mining there this winter.

On Lincoln creek no work has been reported, and so far as I know nothing has been done on this creek this year.

On Davenport creek prospecting was undertaken last winter by driving a tunnel beside and under the creek. This tunnel has been already driven several hundred feet under the creek without encountering bed-rock, but, according to the latest report received, the indications were very promising and the work is still in progress.

On Wilson creek only one or two men did anything this year, and they were prospecting.

On Feather creek two men spent most of the season prospecting, and two or three others did likewise on Slate creek, but I have not received reports from any of them.

On O'Donnel river a number of men were operating and prospecting part of the season, and at one point work of this character which was commenced nearly two years ago is still being prosecuted, but I have had no reports.

Nothing has been reported with respect to development upon Bull, Burdette, Cracker, Fox, Graham, Granite, Hemlock, Horse, Silver, Union, or Volcanic creeks during the past season, although more or less prospecting has been done on most of them.

A considerable number of the leases with respect to which arrears were consolidated last year have been allowed to lapse because the holders were unable to operate them, but nearly as many new leases have been located and are awaiting survey before being issued. It is expected such surveys will be made and the leases issued next season.

MINERAL CLAIMS.

Still another year has passed during which apparently very little has been done in the way of developing quartz properties throughout the district, apart from what was necessary to protect title.

With respect to the silver, lead, gold, and copper properties mentioned in last year's report as being situated in the vicinity of Crater creek, near Fourth of July creek, I may say that the holder of the greater portion of these properties succeeded last spring in interesting certain capitalists in the properties to the extent of sending an engineer in to look them over and do some prospecting-work, but after a few weeks' sampling-work of an apparently perfunctory nature this work was abandoned and the engineer transferred to another field of operation. The properties have since been examined by another engineer, one who has had much experience in noted mining camps where very similar conditions and formations predominated, and he has expressed himself as being very favourably impressed with what he saw, and consequently there is good reason to expect that active development will be undertaken there in the near future.

In the Rainy Hollow section of this district R. W. Wiley had a considerable force of men employed on or about the development of the *Maid-of-Erin* copper property between June and November, but owing to the condition of the wagon-road between the mine and Wells, a distance of about 30 miles, of which 12 miles are in this Province and the balance in Alaska, he was unable to prosecute development satisfactorily, and, in fact, claims to have employed a considerable portion of his force in road-making in order to enable him to transport ore out or supplies in to the mine. I have not had any report from him as to his season's operations, but I have reason to believe he had several hundred tons of bornite ore sacked ready for shipment, and that he succeeded in getting a considerable quantity of it to tide-water at Haines (Alaska),

whence some 55 tons was shipped to the Tacoma smelter. Such reports as I have been able to secure agree in stating that the mine at a depth of over 100 feet is showing up excellently.

With respect to the *Engineer* mine, I need only say that the title and ownership is the subject-matter of pending litigation and that all development is at a standstill.

As to other quartz properties throughout this portion of the district, I may say that the owners are "marking time" awaiting the outcome of the litigation with respect to the *Engineer* mine, and not much, if any, active development is likely to be undertaken until that is settled.

Nothing has been done in the way of developing the coal or hydromagnesite deposits in this district since last report.

Office Statistics—Atlin Mining Division.

Free miners' certificates issued (individual)	320
Free miners' certificates issued (company)	4
Placer records	2
Placer rerecords (representing 176 claims)	163
Leases applied for	28
Leases issued	..
Certificates of work (leases)	202
Leaves of absence (representing 75 claims)	25
Filings (placer)	12
Bills of sale, etc. (placer)	9
Bills of sale, etc. (hydraulic)	27
Bills of sale, etc. (mineral)	9
Mineral records	52
Certificates of work (mineral)	118
Certificates of improvements	18
Filings (mineral)	7
Crown grants issued	8
Gold reported or estimated	$127,600

Revenue.

Land revenue	$ 153 00
Water revenue (rentals)	108 37
Free miners' certificates (individual)	1,466 25
Free miners' certificates (company)	350 00
Mining receipts (lease rentals)	6,593 75
Mining receipts (lease applications)	560 00
Mining receipts (other sources)	2,334 05
Receipts from all other sources	9,990 98
Total	$21,556 40

STIKINE AND LIARD MINING DIVISIONS.

Report by H. W. Dodd, Gold Commissioner.

I have the honour to submit herewith the annual report on mining operations in the Stikine and Liard Mining Divisions of Cassiar for the year ending December 31st, 1921.

Five new placer leases were issued during the year and the holders of mineral claims kept their assessments up.

As the report of the Resident Engineer will cover all developments during the season, I will have nothing more to add.

Office Statistics—Liard and Stikine Mining Divisions.

Revenue collected from free miners' certificates	$ 492 00
Revenue collected from mining receipts	1,393 30
Revenue collected from other sources	5,008 34
Total	$6,893 64

SKEENA DISTRICT.

SKEENA AND BELLA COOLA MINING DIVISIONS.

REPORT BY J. H. McMULLIN, GOLD COMMISSIONER.

I have the honour to forward you herewith the office statistics of the Skeena and Bella Coola Mining Divisions for the year 1921.

The report of the Resident Mining Engineer fully covers the mining development for the year and I have nothing further to add to his report.

OFFICE STATISTICS—SKEENA AND BELLA COOLA MINING DIVISIONS.

Free miners' certificates issued	429
Special free miners' certificates issued	17
Mining receipts issued	125
Certificates of work issued	174
Bills of sale, etc., recorded	33
Filings	8
Certificates of improvements granted	1

Revenue.

Free miners' certificates	$2,430 75
Mining receipts	1,573 65
Total	$4,004 40

NASS RIVER MINING DIVISION.

REPORT BY JOHN CONWAY, ACTING MINING RECORDER, ANYOX.

OFFICE STATISTICS—NASS RIVER MINING DIVISION.

Free miners' certificates (individual)	259
Free miners' certificates (special)	2
Mineral claims recorded	218
Certificates of work issued	543
Bills of sale, etc., recorded	115
Filings	43
Certificates of improvements recorded	22

Revenue.

Free miners' certificates	$1,299 00
Mining receipts, general	3053 50
Total	$4,352 50

PORTLAND CANAL MINING DIVISION.

REPORT BY J. J. SCARLETT, ACTING MINING RECORDER.

I have the honour to submit herewith office statistics for the Portland Canal Mining Division for the year ending December 31st, 1921.

The report of the Resident Engineer deals fully with the mining activities in this Division during the past year.

Office Statistics—Portland Canal Mining Division.

Free miners' certificates (individual)	309
Free miners' certificates (company)	2
Free miners' certificates (special)	4
Mineral claims recorded	328
Certificates of work issued	443
Bills of sale, etc., recorded	112
Certificates of improvements recorded	63
Filings	56
Abandonments	7

Revenue.

Free miners' certificates	$1,759 00
Mining receipts, general	3,994 85
Other sources	632 50
Total	$6,386 35

QUEEN CHARLOTTE MINING DIVISION.

Report by J. L. Barge, Mining Recorder.

I have the honour herewith to submit my annual report for the Queen Charlotte Mining Division for the year ending December 31st, 1921.

Copper Island.—Work on this property has been steadily carried on by A. Heino in a small way with very good results. It is reported that Mr. Heino has bonded his iron properties to a Vancouver syndicate.

Ikeda Mines, Ltd.—Work on this property has been in abeyance during the past year, a watchman only being maintained.

Jedway.—The *Thunder* group at Collison bay has been bonded and deals for two other properties are pending, which indicates renewed activity in this part of the Division in the early spring. Campbell & Wild have done considerable work on the *Mother Lode* and *Bank of Commerce* claims and showing up a good body of ore.

Shuttle Island.—The *Ellen* group, taken over by a Vancouver syndicate during the summer, has not been actively developed: operations are in abeyance until a final settlement is reached.

Louise Island.—The *Iron Duke* group and adjacent iron claims have had the usual assessment-work done, as well as having been surveyed, and certificate of improvements have been applied for; while opposite Louise Island, in Cumshewa inlet, preparations are being made to resume work on the *Go East* and *Homestake* groups.

South Easter mines have not been operated this year.

Blue Mule Group.—Jones, McRae & Wiggs have uncovered some very good ore in Kootenay harbour. J. H. Jones and Nels Larsen have the property leased for a term of three years and are actively engaged in development.

Gold Harbour.—T. R. Davey and Nils Persen leased the *Early Bird* group for a short term from J. McLellan and have produced very fair returns.

Black Sands.—On the east and north coast of Graham island considerable staking of the beach sands as placer leases has been in progress. Fourteen leases have been issued and four others applied for, and thorough preparations have been made for an early start on productive work early in 1922.

Office Statistics—Queen Charlotte Mining Division.

Free miners' certificates issued	59
Mining claims recorded (quartz)	27
Mining claims recorded (placer)	4
Placer leases issued (hydraulic)	14
Placer leases applied for (hydraulic)	4
Certificates of work issued	62
Bills of sale, etc., recorded	34

Revenue.

Free miners' certificates	$ 312 25
Mining receipts	803 00
Trade licences	205 00
Firearm licences	122 50
General receipts (P.C.F.)	191 00
Liquor permits	25 00
Marriage licences	10 00
Poll-tax	10 00
Total	$1,678 75

NORTH-EASTERN DISTRICT (No. 2).

Report of John D. Galloway, Resident Engineer.

GENERAL REMARKS.

The North-eastern Mineral Survey District consists of Omineca, Cariboo, Quesnel, and Peace River Mining Divisions, and occupies a large portion of Northern British Columbia, having an area of nearly 100,000 square miles. The northern, western, and southern boundaries of this district are the arbitrary boundary-lines of the Mining Divisions, but these, where practicable, always follow the watersheds of the country. The eastern boundary is the British Columbia-Alberta boundary-line. The western boundary is roughly 100 miles from the Coast, while the northern and southern boundaries are about 200 miles from the respective Provincial boundaries.

For descriptive purposes in this report the district is reviewed under the main headings of the Mining Divisions, subdivided into sections as follows:—

Omineca Division—Skeena section; Hazelton section; Telkwa section; Babine section; Fraser Lake section; Manson section.

Cariboo Division—Fort George section; Vanderhoof section; Barkerville section; Cottonwood section.

Quesnel Division—Quesnel River section; Horsefly section; Keithley section.

Peace River Division.

A general description of the geographic, geologic, and topographic features of the district was given in the Annual Report of the Minister of Mines for 1917. In the following table is given a list of the more important reports on this district, in addition to which numerous references can be found in the Summary Reports of the Geological Survey and the Annual Reports of the British Columbia Department of Mines:—

Name of Author.	Publication.	Year.	Page.
Dr. Geo. Dawson	Geological Survey of Canada	1875	233
"	" "	1876	17
"	" "	1879	Pt. B
"	" "	1888	73R
Amos Bowman	" "	1887-8	Pt. C
R. G. McConnell	" "	1894	5c
W. Fleet Robertson	Minister of Mines' Report	1905	89
"	" "	1906	101
"	" "	1908	66
"	" "	1911	95
"	" "	1912	65
W. W. Leach	Geological Survey of Canada, Summary Report	1906	35
"	" " "	1907	19
"	Telkwa River and Vicinity, Geological Survey	1907	..
"	Geological Survey of Canada, Summary Report	1908	41
"	" " "	1909	61
"	" " "	1910	91
G. S. Malloch	" " "	1911	92
R. G. McConnell	" " "	1912	55
G. S. Malloch	" " "	1912	69
"	" " "	1912	103
C. F. J. Galloway	Minister of Mines' Report	1912	118
W. M. Brewer	" "	1914	101
John D. Galloway	" "	1914	176
J. D. MacKenzie	Geological Survey of Canada, Summary Report	1915	62
Chas. Camsell	" " "	1915	70
John D. Galloway	Minister of Mines' Report	1916	134
"	" "	1917	86
"	" "	1918	107
J. J. O'Neill	Memoir 110, Geological Survey	1919	..
John D. Galloway	Minister of Mines' Report	1919	96
J. C. Gwillim	Report of Oil Survey, Peace River District, B.C., Department of Lands	1920	..
John D. Galloway	Minister of Mines' Report	1920	79
John A. Dresser and Edward Spieker.	Report of Oil Surveys, Peace River District, B.C., Department of Lands	1920	..
R. W. Brock	Summary Report, 1920, Part A, Geological Survey	1920	81

SUMMARY OF MINING ACTIVITY.

In a consideration of the mining activity in the North-eastern District during 1921, it should be remembered that the year was a most depressing one for the mineral industry throughout the American continent. Low metal prices and an oversupply of almost all metals caused drastic curtailment of production everywhere. Furthermore, the financial conditions were such as to make it a most unfavourable year in which to expect an influx of capital for the acquirement of new mineral properties.

Considering these adverse influences which prevailed, the condition of the mining industry in the North-eastern District during the past year was better than might have been expected. While but little lode-mineral production was made, a substantial increase in the placer-gold output as compared with 1920 is an encouraging sign for the future. With a return to normal market conditions for the different metals, a resumption of lode-mineral shipments from the district will probably soon take place.

Development of mineral properties was proceeded with in many parts of the district and more prospectors were in the hills than for some years past. Besides the actual exploratory work of looking for new mineral discoveries, much work is done in the course of a season by prospectors on the properties that they own. In quite a number of instances of work of this nature done this summer the showings of ore have been improved and the general results obtained were satisfactory. There are now in the North-eastern District a considerable number of prospects carrying a great variety of ore and metals which should prove attractive to those who are looking for prospects that have some chance of developing into profitable mines.

Placer-mining was vigorously prosecuted in the Cariboo and the indications are that the yearly placer-gold production of that section will soon again increase to equal that of pre-war years. Particularly interesting is the reopening of the old *Bullion* mine at Quesnel Forks, which property was at one time the most important hydraulic mine in British Columbia.

The *Silver Standard* mine and concentrating-mill at Hazelton was closed all year; operations are to be resumed in January, 1922. The condition of the mine is satisfactory and the reason for closing down near the end of 1920 was owing to the difficulty of marketing silver-lead and silver-zinc concentrates.

The development of a very promising coal property on the Telkwa river was commenced during the year. This property, known as the *Betty* mine, has a thick seam of good-grade coal which will prove highly satisfactory as a steam-coal or as domestic fuel. The operations at the mine are as yet on a small scale, but once the high quality of this coal is known it will command a good market. The opening-up of a source of a steady supply of good coal will undoubtedly assist the growth and prosperity of Northern British Columbia.

So far as is known, the only ore shipments made this year were a car-load of concentrates from the *Silver Standard* (clean-up of mill-bins), a small shipment of gold ore from the *Hazelton View*, and a few tons as test shipments from different properties. The production of placer gold was $70,000, as compared with $69,000 in 1920. The coal shipments from the *Betty* mine amounted to 800 tons.

PLACER-MINING.

Mining in the North-eastern District commenced many years ago with the working in the sixties of the bonanza placer-gold fields of the Cariboo. Since that time placer-mining has been continuously carried on in the Cariboo, but, as might be expected, the yearly production has declined considerably from that of the early years. During the war years the production of placer gold still further declined, but it is apparent that an upward trend has now started, as the production is greater for 1921 than for the preceding year, and the plans now under way will undoubtedly result in a largely increased production in the future.

The easily available, rich diggings of the Cariboo District are apparently for the most part worked out, but this is a generalization which may have many exceptions, as was shown this year by the discovery of rich ground on Cedar creek, in the Quesnel Forks section. Further exploration is continually being directed in the hope of finding continuations of the old rich "leads," or portions of the leads that were overlooked by the old-timers, and a certain percentage of successes always rewards these fresh efforts. It will be seen, therefore, that the Cariboo District still has possibilities for the prospector and the small mining syndicate.

The greatest resource of placer gold in the Cariboo District, however, is in the low-grade gravels, which must be worked on a large scale by hydraulicking, dredging, or deep-drifting methods with adequate machinery. Placer-mining of this nature calls first of all for thorough testing of the ground to determine the average values; and, secondly, for plenty of capital so that the property can be properly equipped.

Besides the operating properties, there are at the present time in the Cariboo District a number of companies engaged in prospecting or equipping properties for such large-scale placer-mining. And there is still much ground left that at least warrants preliminary testing to see if it will not pay to work by dredging or other methods.

There are several reasons why placer-mining in the Cariboo District should experience a renewed impetus in the near future. In the first place, the adverse conditions of high costs without increased value of his product which militated against the gold-miner during the war years have practically disappeared. Wages and all costs are practically back to those of pre-war years. Secondly, the completion of the Pacific Great Eastern Railway into Quesnel has materially lessened freighting costs into the Cariboo. Formerly it was necessary to haul machinery and equipment from Ashcroft by wagon or motor-truck, with the result that in many cases the freight was higher than the first cost of the article. At the present time Barkerville is only 60 miles by motor-road from the railway at Quesnel, as compared with 280 miles from Ashcroft. And Barkerville is about the farthest point in the district from the railway, there being much promising placer-ground on the Fraser, Cottonwood, and other rivers and creeks only a few miles from the railway.

Another placer-gold field in the North-eastern District which attracted considerable attention at one time is what was known as the "Omineca"; this consists of the Manson and Ingenika sections of the Omineca Mining Division. Certain rich creeks in these sections were worked many years ago and intermittent mining was carried on until recent years. With the decline of gold-mining during the war years and the lack of prospectors in the hills, the district was virtually abandoned and now there is but a small production from it.

There is in this part of the Omineca Mining Division a very large area still to be thoroughly prospected for placer gold. The country lying at the headwaters of the Skeena, Stikine, and Finlay rivers should yet yield some rich placer-gold creeks, and it would not be surprising if the next placer stampede was to this section. Around the old placer-workings of the Manson and Ingenika sections there is undoubtedly much low-grade ground which would pay to work by modern methods, but the handicap of lack of transportation has so far prevented much development of this nature. At the present time the means of access to these sections is by pack-trail from Hazelton or from Fort St. James, and the distance from the railway is over 200 miles. It is obvious, therefore, that only the richest of the placer-gravels could be worked with any chance of success. The field, however, is a promising one for testing the possibilities for large-scale hydraulicking and dredging, as, if sufficient pay-ground was found, the transportation could be materially improved by the construction of a wagon-road.

LODE-MINING.

Active lode-mining in the North-eastern District has been mainly confined to the territory contiguous to the Grand Trunk Pacific Railway. While this railway was being constructed much prospecting was carried on in the Skeena, Hazelton, and Telkwa sections of the Omineca Mining Division. The railway was finally completed in 1914 and about that time the first ore shipments were made. Since that time lode-mining has gradually progressed in the district, but not quite as rapidly as had been hoped. It should, however, be remembered that the development of new mines is a slow process, especially in a country where lack of transportation is a great handicap. There are undoubtedly many prospects in this district which will repay systematic exploration, but it is a difficult matter to interest capital. In a few cases the owner of the property asks a higher purchase price than apparently any one is willing to pay, while in others the transportation problem is a difficult one to solve. During the year 1921 this district, in common with every mining district in North America, suffered more or less from the depression in mining. The great necessity for this district is to interest capital in developing the properties which are now lying dormant, and this year has been an unfavourable one for the inception of new mining business of any magnitude. A few examining engineers went through the district, but they did little in the way of acquiring property. There is

every reason, however, to expect much more activity during 1922. The *Silver Standard* mine at Hazelton, which has been closed for a year, is to be reopened in January, 1922. A number of "deals" are pending and generally the prospects for the coming year are quite bright.

PROSPECTING POSSIBILITIES.

The general statement that Northern British Columbia has vast areas of virgin ground for the prospector has been repeated many times, but it seems advisable to elaborate somewhat on the idea. In the years immediately prior to the completion of the Grand Trunk Railway there was a rush of prospectors to the mountains bordering the Skeena and Bulkley rivers and their tributaries. The country was "run over," but undoubtedly much of it was not thoroughly prospected and many spots, especially if a little distance from the main trails, were never looked at. A certain number of these prospectors staked claims and to some extent at least settled down on them to make them into mines. In certain cases the prospects justified holding and development, but in many others good prospectors were tied down to the development of property which never could prove of value. The great majority of the prospectors who first came into the country soon left it for other fields, as the true prospector is a wanderer. Since the first rush of prospectors but few others have come into the country, and in recent years prospecting in the district has been carried on practically entirely by those prospectors from the first rush who stayed in the country to hold property. While many of these men are good prospectors, their main objective is not prospecting, but the selling of the various claims they have held for years, and, furthermore, as a rule their prospecting is confined to the immediate vicinity of their holdings. What the country needs is a fresh influx of prospectors who will prospect anywhere in the district and not confine their activities to certain areas.

Outline of Promising Sections.

It will be well to analyse in some detail the district with a view to pointing out to prospectors favourable places to prospect. It has been frequently mentioned that the eastern contact-zone of the Coast mountains is in many places well mineralized. Inasmuch as these mountains extend as a series of mountain ranges from the southern boundary of British Columbia to Alaska, the eastern contact-zone is a narrow belt of country 1,000 miles at least in length. That this belt is an important mineralogical district is shown by the important mining camps situated along its course, as, for instance, Yale District, Bridge River, Skeena section, Alice Arm, Anyox, and Stewart. The Hazelton-Telkwa sections lie in the contact-zone of the Bulkley and Babine mountains some distance east of the main eastern contact-zone of the Coast mountains. Mineralogical conditions in the Babine and Bulkley mountains are somewhat similar to those of the eastern contact-zone of the Coast mountains and form a parallel belt to the east.

The eastern contact-zone of the Coast mountains in the North-eastern District is defined by the Kitsumgallum Valley trench. It must be remembered, however, that this contact-zone is an irregular and indefinite area varying greatly in width, and is always an area in which the general rock formations consist of sediments and volcanics intruded by more recent irruptive rocks, such as granites, diorites, granodiorites, and allied rocks, in the form of batholiths, bosses, and dykes.

According to our present ideas of ore-deposition, it is believed that the great majority of our metallic mineral-deposits are formed as the culminating process in the intrusion of deep-seated molten magmas upward and through the overlying rock formations. In a region, therefore, where such igneous intrusions have taken place on a tremendous scale it is to be expected that valuable ore-bodies would be found. It should be pointed out here that such ore-bodies do not necessarily occur directly at the contact of the intrusive rocks with the older rocks, but may be found at considerable distances from the contacts; and, further, that they may occur either in the older rocks or in the intrusive rocks. The *Rocher Déboulé* mine at Hazelton is an example where the ore-body occurs in the granodiorite intrusive, and the *Silver Standard* mine at Hazelton is an example of the ore-body occurring in the older sedimentary formation at some distance from any intrusive granitic rock.

In considering suitable places for prospecting, the guiding factor should be a consideration of the general geology of the area and whether or not this indicates the area to be one of possible or probable mineral occurrences.

In the North-eastern District the eastern contact-zone extends from Eutsuk lake in a north-westerly direction nearly to the Nass river, a distance of about 200 miles. This zone has been prospected at different points and in many places claims have been staked, but it will repay much further intensive prospecting. The area lying between Terrace, on the Skeena river, southerly to Tahtsa lake has never been prospected and but little is known about it.

Lying to the east of the eastern contact-zone of the Coast mountains are the Zymoetz, Rocher Déboulé, Hudson Bay and other ranges known collectively as the Bulkley mountains. These ranges consist for the most part of sedimentary and volcanic measures with cores of granitic rock. The granitic batholiths are for the most part small and form only a small proportion of the total rock formation. There is, however, plenty of evidence that widespread mineralization has followed the intrusion of the plutonic rocks and dykes.

Many parts of these ranges have not been carefully prospected, as, for instance, Porphyry creek, 20-Mile creek, and others draining the country lying between the Rocher Déboulé and Hudson Bay mountains, and also many parts of the Seven Sisters and Zymoetz ranges.

Lying to the east of the Bulkley mountains and separated from them by the Bulkley river is the Babine range. This range consists dominantly of altered sedimentary and volcanic rocks, with a small proportion of intrusive rocks. Valuable ore-bodies have been found in different parts of the range and wherever prospected there are found evidences of mineralization.

The Babine range has a length of somewhat over 100 miles, and, commencing at the Babine river, extends south-easterly to the portion of the Bulkley river that flows westerly. The southern termination of the range is indefinite, as it gradually fades away into plateau country. The whole of this range of mountains is promising country for prospecting and there are many parts of it that have not been closely examined.

Still farther to the east and north, the country surrounding Takla lake and Driftwood river is believed to be mineral-bearing. Some good specimens of native copper have been brought out of this section. This part of the district can be easily reached by water route from Fort St. James, which point is connected by motor-road to Vanderhoof, on the Grand Trunk Pacific Railway.

As has been previously mentioned, the Manson section is an old placer camp. Gold-bearing quartz veins and galena ores are reported from this section, but the distance from transportation is such that but little prospecting for lode minerals has been done.

In the Barkerville section of the Cariboo Mining Division the presence of numerous quartz veins has long been known. At different times in the last forty years attempts have been made to work these veins for their gold content, but as yet no great success has attended these efforts.

It is apparent that the gold values in these quartz veins are very irregular and spotted. But it seems quite possible that shoots of ore rich enough to mine and mill will yet be found in some of these veins. Throughout the Cariboo Division generally, and extending to the Fort George section, quartz veins occur in abundance, and while undoubtedly many of them are barren, it is possible that a small percentage of them will be found to be well mineralized. Similar quartz veins are found in many parts of the Quesnel Division.

The eastern end of the Cariboo Division contains portions of the Columbia and Rockies systems of mountains. These mountains are separated by the Rocky Mountain trench, which at this point is occupied by the Fraser river flowing north-westerly, and here the Grand Trunk Pacific Railway follows the Fraser to its headwaters in the Yellowhead pass.

In this section mica-deposits are known to occur at Tete Jaune and the occurrence of other minerals are reported, including copper and iron ores. The section is one which is virtually unprospected, and when it is remembered that it is in the Columbia system of mountains that the important mineral camps of East and West Kootenay are situated, it is apparent that there is here a large area with great possibilities of mineral occurrences.

OMINECA DIVISION.

Skeena Section.

Zymoetz River.

The Zymoetz river is an important tributary of the Skeena river, which rises in the Telkwa mountains and, flowing westerly, joins the Skeena river at Copper City, about 100 miles easterly from Prince Rupert. Many mineral claims have been staked in the mountains along the

Zymoetz river and its tributaries, and there are important deposits of iron ore and coal near the headwaters of this river.

Snowflake Group.

Late in 1920 this group of claims, owned by John Gabriel, of Copper City, was bonded by D. A. Buchanan, who represents a private syndicate. The group is situated 12 miles up the Kitnaiakwa river, a tributary stream joining the Zymoetz river 28 miles from its mouth. The claims are on Gabriel creek, about half a mile from the Kitnaiakwa river, and the total distance of the property from Copper City is approximately 40 miles.

Before anything could be done on the property it was necessary to do some trail-construction. A ferry was put in at Mile 28 on the Zymoetz river and a trail was constructed on the last 5 miles of the route into the property. This work was done by Mr. Buchanan, with a grant of $1,000 towards the cost being made by the Mines Department; this grant was made on the usual 50-per-cent. basis. The trail-work was finished in September, 1921, and shortly after Mr. Buchanan packed in supplies to carry on development-work during the winter. Development has been started with a small crew of men and it is expected that it will be continued all winter.

The showing on the property was found at the top of a small waterfall on Gabriel creek, the vein being well exposed crossing the rocky canyon of the creek. The vein really consists of a mineralization along the walls of a dyke. This mineralization is well developed on the hanging-wall side of the dyke and only slightly so on the foot-wall. On further exploration, however, it is quite possible that both walls of the dyke may be found to be well mineralized. The dyke is from 7 to 8 feet wide and strikes at S. 25° E., with a dip of 75° to 80° to the south-west. The country-rock through which the dyke cuts is red andesite and the dyke itself is diorite porphyrite.

The mineralization on the hanging-wall of the dyke consists of a partial replacement of the andesitic rock with metallic sulphides and small amounts of quartz and calcite. The metallic minerals present are arsenical iron, grey-copper, and small flakes of native silver. The total amount of metallic minerals forms only a small percentage of the total gangue. The chief value in the rock is silver, the copper content being quite low. According to Mr. Buchanan, the average values are high, quite sufficiently high to warrant the development of the property.

There is a well-defined foot-wall to the deposit, this being the wall of the dyke; but the hanging-wall is indefinite, as the mineralized gangue material gradually changes to unaltered andesite. It is assumed by Mr. Buchanan that from 4 to 6 feet in width of the deposit may be classified as ore.

As yet very little development has been done on the property. The discovery showing is naturally exposed by the creek and a large open-cut has been made on this on one side of the creek. Along the strike of the dyke no work has been done to uncover it and the only exposure of the dyke is up and down the walls of the canyon.

The development-work that is planned on the property is to crosscut by means of a tunnel from a point below the falls, which will give a depth of 50 feet or more below the outcrop of the ore-body. After the vein (dyke and mineralization) is cut there will be a good opportunity to drift on the vein in both directions and gain depth as the work proceeds.

Iron and Coal.

It was expected that some development-work would be done during the year on the limonite-iron showings and the coalfield on the headwaters of the Zymoetz river. These properties, which have been described in previous Annual Reports of the Minister of Mines, are at present held under option by A. C. Gardé. The development plans apparently did not materialize this year, but it is expected that work will proceed in 1922.

There are many claims along the Zymoetz river and a number of the more important ones have been described in the Annual Reports of the Minister of Mines. The *Dardanelle* group, 15 miles up the river, was examined this year by an engineer for the Granby Company.

Dardanelle Group.

This group consists of four claims known as the *Trail*, *Trail Fraction*, *Independent*, and *Dardanelle*, and is owned by A. Carmichael, James Crocker, and George W. Kerr. The claims are situated near the 13-Mile post on the Zymoetz River trail, some of the workings being just below the trail and the others above. There is a cabin on the property situated close to the lowest working, the elevation at this point being about 450 feet above sea-level.

The rock formations exposed on the property are greenstone (probably altered diabase) and a porphyritic felsite that occurs more or less in dyke form. Not far distant there are intrusive bodies of granodiorite. There are several outcroppings of quartz which probably represent two distinct veins, which are more or less parallel and close to one another. These veins are in several places lying in the contact between the greenstone and the porphyry and at least in one place wholly within the greenstone. The gangue is entirely quartz and the metallic minerals present are chalcopyrite, pyrite, arsenopyrite, bornite, and galena. The total amount of metallic minerals, however, forms but a small proportion of the total vein-filling. The values are apparently mainly in copper, with varying and, in places, important values in gold and silver. The lead content as a rule is unimportant.

On the lower side of the trail there is a tunnel 45 feet long, a shaft 25 feet deep, and several open-cuts which prospect different quartz-croppings. As shown by these workings, the vein or veins are from 2 to 4 feet in width and are sparingly but fairly regularly mineralized with sulphides of iron and copper. An average sample taken across 4 feet of vein on the east side of the shaft 5 feet above the bottom returned on assay: Gold, trace; silver, trace; copper, 1.2 per cent.

The workings above the trail are about 500 feet higher in elevation than the lower workings. It seems highly probable that the quartz-croppings at this point are continuations of the two veins shown in the lower openings. The showings are developed by some shallow shafts and cuts, which show the veins to have a width of from 4 to 5 feet. The most abundant sulphide noted was pyrite, which, however, does not occur in large amounts. A grab sample from the dump of a 10-foot shaft gave an assay of: Gold, 0.6 oz.; silver, 11.4 oz.; copper, 2.4 per cent.

The property is favourably situated, not too far from rail transportation, and with available water-power near by. The veins are well defined and should prove permanent. The main question is one of values, which, as shown by the present development, seem to be somewhat low. However, it is quite possible that these veins may carry shoots of ore which could be extracted at a profit. The high silica content of the ore might be useful to certain smelters as a flux, thereby ensuring a favourable smelting rate on the ore.

Usk.

In the vicinity of Usk development operations and prospecting were continued throughout the year, but no ore shipments were made. The Usk District collection of ore specimens again won the Grand Challenge cup at the Prince Rupert Fair, and the cup having been won for two years in succession, it now becomes the permanent property of Usk District.

Kitsalas Mountain Copper Co.

Early in the year this company resumed development of the No. 2 vein (blind-vein) exposed in the crosscut tunnel. This vein had been developed by a winze a few feet deep and this winze was deepened to 30 feet. The vein improved in size and values with this work, there being 5 feet of pretty well mineralized quartz at the bottom. Average assays by the management are said to show it to be a satisfactory grade of ore. As working in this winze was expensive and troublesome owing to a considerable stream of water, it was decided to run a lower crosscut tunnel so as to cut this vein at a point below the bottom of the winze. This crosscut tunnel will be about 400 feet long to strike the vein, and will give a depth of 80 feet below the top of the winze. The crosscut was started on August 1st and the work is being continued steadily. At the commencement of the tunnel a considerable thickness of surface wash had to be penetrated and for a time considerable trouble was experienced in driving through a mixture of loose sand and clay. This material flowed so readily that it was necessary to use face-boards and timber the whole drift tightly. By the middle of November the tunnel was in 130 feet and still in loose gravel. For detail descriptions of this property *see* previous Annual Reports.

Kleanza Co.

This company was primarily organized as a lumbering and sawmilling concern, but in a short time became also interested in mining activities. In 1919 the company acquired the *Golden Crown* group and carried out some development-work. Several groups of claims were then secured, extending from the *Golden Crown* group on up to the top of Kleanza mountain. A sketch-map showing the holdings of the company appeared in last year's Annual Report.

On the property held by the Company there are a large number of quartz veins which vary in width from a few inches up to 5 feet. The general formation of Kleanza mountain is grano-

diorite, which in places is somewhat basic and schistose. The quartz veins have a general strike of north-west and south-east and are therefore roughly parallel. The important sulphide minerals which are found in these quartz-filled fissures are pyrite, arsenopyrite, and small amounts of chalcopyrite. The important value is gold. The mineralization is irregular, as some of the veins are apparently barren of minerals, while others carry in places considerable amounts of sulphides. The arsenopyrite would seem to carry most of the gold, although some of it may be also in the chalcopyrite.

The work so far done consists of a number of tunnels on the *Golden Crown* group and considerable open-cutting and stripping and short tunnels on the *Valhalla* and *Kleanza* groups. Further work was carried on during the summer of 1921 with a small crew of men and stopped for the winter when the snow came.

It is hoped by the management that some of the veins will on development be found to carry shoots of ore that will pay to mine and mill. It is realized that some of the veins are barren, but others carry good values in places, and development may show a sufficient tonnage of such ore to warrant the erection of a mill.

There is a good water-power on Kleanza creek which the company has commenced to develop in connection with its sawmill, which has been erected. The mineral property of this company is conveniently located, from 3 to 5 miles from the railway, with an available water-power and plenty of timber at hand.

K. Partnership.

During the summer the "K. Partnership" (H. H. Gillson, manager) acquired a lease on the *Golden Crown* group. This property is situated near the foot of Kleanza mountain, about 3 miles from Usk, and is controlled by the Kleanza Company. A Ross mill was erected on the property by the leasing syndicate and a test run was made on ore from one of the dumps. The Ross mill is a recently patented machine designed to treat gold ore. It is in effect a grinder and amalgamator contained in a small upright steel cylinder, the grinding being done by steel balls which revolve around in a groove. The ground pulp is splashed out through openings by the rotating action of the machine. Amalgamation takes place on baffle-boards inside the machine, and, if desirable, the pulp from the machine can be passed over an amalgam-plate.

The Ross mill is made in sectional parts, so that it can be packed anywhere and used for small-scale operations. In trying out the Ross mill at the *Golden Crown* a small crusher was used for reducing the ore to ½-inch size. This crusher was much too small as it would only handle a few hundred pounds a day, whereas the mill would treat from 5 to 10 tons a day. Work was stopped by the partnership in a short time and their future plans are not known.

Information regarding the Ross mill can be obtained from J. D. Ross, 291 Dufferin Street East, Vancouver, B.C.

Kleanza Creek.

Further work was done in putting in the new piece of trail from Usk to the head of Kleanza creek during the summer. The usual assessment-work was done on a number of groups of claims in this section and some of the properties were examined by scouting engineers looking for copper properties.

Legate Creek.

The claims situated in the mountains at the head of Legate creek have not had as much attention paid to them as they would seem to warrant. A number of these showings have been described in previous Annual Reports of the Minister of Mines. The different properties are situated from 1 to 3 miles from the forks of the creek. The main trail from Pacific goes to the forks, a distance of about 12 miles, and from this point there are branch trails to the different properties. The locality is easy of access and the distance of the claims from the railway is not prohibitive.

On some of the properties quartz-filled fissure-veins occur carrying galena, tetrahedrite, pyrite, chalcopyrite, and other iron and copper sulphides. The important value is in silver and some very high-grade ore is found in places. The ore is high enough grade to stand packing out if hand-sorted, and the properties might be opened up in this way to the point where there would be sufficient milling-ore to warrant the erection of a mill.

On other properties, notably the *M. & K.*, important copper values, together with silver and lead, occur in the ore. This property with some others was taken up in 1920 by the British

Columbia Exploration Company. This company apparently lost its interests in this section through a sheriff's sale of their assets this summer.

The *Halliday* group has been further developed by the owner during the last two years and he now reports that the showing is a very promising one.

The district generally will repay systematic examination by scouting engineers.

Hazelton Section.

Silver Standard.

This mine, which was closed down in October of 1920, remained closed all year. There was some possibility of the mine being reopened late in the fall, but this did not materialize. The reasons which caused the management to close down in 1920 were the high operating costs and high freight rates on concentrates, together with the lessened market price of silver, which is the most important value in the ore. Conditions now are considerably better than when the mine was closed, as silver is higher in price and there has been a considerable drop in wages and the costs of mining supplies. The high freight rates, however, still prevail, and in the case of this company shipping silver-lead concentrates to the Trail smelter and silver-zinc concentrates to Oklahoma, the amount paid out in freight is a very considerable proportion of the value of the ore. The mine is in good shape and there would seem to be every reason for expecting operations to be resumed early in 1922. A car-load of concentrates was shipped from the mill this summer representing a clean-up of odd lots around the mill-bins.

At the time of writing this (January, 1922) the mine has been reopened with a crew of about fifteen men under the superintendency of W. G. Norrie-Lowenthal, who was in charge during the previous operations. It is not expected that the mill will be started until March. Detail descriptions of this property can be found in previous Annual Reports.

Delta Copper Co.

A contract for 1,000 feet of diamond-drilling on the property of the Delta Copper Company was let in the fall of 1920 to Lynch Bros., of Spokane. On account of snow it was impossible to carry out this work last winter, but as soon as practicable this summer the drilling was carried out. On the completion of the 1,000 feet of drilling all work was stopped and the future plans of the company are not known. The results obtained from the drilling have not been made public.

Thoen Basin.

One of the old highways of the country before the days of the Grand Trunk Pacific Railway and motor-roads was the Babine trail, which commenced at Hazelton and crossed through the heart of the Babine range to Babine post (Hudson's Bay Company's post), on Babine lake. Extensions of this trail served the placer-fields of the Omineca and Ingenika. This trail is still extensively used, but does not have as much travel as in former years. This trail enabled lode-mineral prospectors to prospect that portion of the Babine range contiguous to the trail, and some years ago many claims were staked in this part of the range. Many of these claims have since been abandoned, and, generally, little or nothing in the way of development or prospecting has been done in this section of the country in the last four or five years. It would seem that many of these old locations were never given proper consideration, and, inasmuch as there is evidence of widespread mineralization in this section, it is apparent that it is still a promising field for prospecting. Some of the abandoned claims may warrant development, and more intensive prospecting than was done at the time of the first running-over of the country may be well repaid by important new discoveries.

The Babine range is a well-defined range unit extending from the Babine river on the north to the westerly flowing portion of the Bulkley river on the south, a distance of about 100 miles. The range has a width varying from 30 to 60 miles. Roughly, these mountains are encompassed by the Babine and Bulkley rivers and Babine lake. The Babine range belongs to the Interior system of mountains and differs considerably from the mountains of the Pacific system lying to the west. Granitic rocks are not nearly as plentiful as in the Pacific system. So far as is at present known, the great batholithic activity of the Pacific system is represented in the Babine range only by minor batholiths, bosses, and a wide variety of dyke and apophysal forms. There

is, however, considerable similarity between the Bulkley mountains of the Pacific system and the Babine mountains. Rocks belonging to the Hazelton formation are the predominant measures in both sets of mountains, with, however, a greater development of batholithic granitoid rocks in the Bulkley mountains.

Topographically the Babine range presents considerable diversity of types. The southern end of the range merges almost imperceptibly into the Nechako plateau, while easterly from Hazelton the mountains are high, rugged, and alpine in character. In that portion of the range contiguous to the Babine trail elevations up to 7,500 feet are found and many small glaciers and snow-fields occur. Timber-line is at from 4,000 to 4,500 feet. Much country lies above timber-line and this is easily prospected, but the season is of course short, as the snow does not go off until June or July and may come again at the end of September.

The Babine trail follows the Bulkley river for a few miles after leaving Hazelton and then continues on up the Suskwa (Bear) river, a tributary of the Bulkley, to its head and then down to Babine lake. Coming into the Suskwa on both sides are a number of tributary creeks which head up into the high peaks of the Babine range, and at the heads of a number of these creeks claims have been staked. One of these creeks is known as 31-Mile creek, so named because the 31-Mile post on the Babine trail is situated about where the trail crosses the creek. The country at the head of 31-Mile creek is known as Thoen basin, named after Henry Thoen, an old-time prospector of this section. From the main trail to the head of this basin there is a branch trail 3 miles long. Thoen basin proper is a large basin at the head of the creek, which is split in two parts by a long spur running down from a high peak. Claims have been staked on both sides of the basin and over the divide and in adjoining basins at the heads of smaller creeks. All claims in this locality are commonly referred to as being situated in Thoen basin.

A trip was made into Thoen basin late in September and it had been intended to examine all the claims in that section. Unfortunately an early snowfall made it necessary to get the horses out at once and only some of the claims were examined. A deposit of low-grade copper ore situated over the divide from Thoen basin and owned by Henry Thoen and partners was one of the properties which unfortunately was not examined. The elevation of the divide at this point is about 6,500 feet and it is a bad place to cross unless in fine weather.

There is an abundance of water-power available on various creeks throughout this section, as owing to the mountainous nature of the country the creeks descend rapidly.

True Fissure.

This property is situated on the western side of Thoen basin and extends up the steep mountain-side. It is owned by Gordon McLennan and Pete Jennings. The lowest showing is at an elevation of 5,600 feet and the upper showings are at about 6,300 feet, while the vein apparently continues above this in steep bluffs. The rock formations exposed on and near the property consist of quartzites, argillites, and tufaceous rocks of the Hazelton formation, which are intruded by a small boss of granite. This intrusive rock is a light-coloured medium-grained biotite granite and has considerably affected by metamorphic action the sedimentary measures near the contact. Dioritic dykes also cut the formation; these dykes are characterized by long crystals of feldspar.

The main ore-showing on the property is a fairly well-defined replacement-fissure type of vein which is well exposed, cropping at different points up and down the mountain-side. The vein has evidently been more of a sheared zone than an open fissure and in places the ore is "frozen" to the walls. The vein strikes north-east (mag.) and dips at 55° to the north-west. The sulphide minerals found in this vein are galena, zinc-blende, pyrite, and small amounts of grey-copper. The gangue is mostly altered wall-rock, but some quartz occurs in places. The ore in places is a brecciated mass of sulphides and fragments of more or less silicified wall-rock. The wall-rock is of variable character, depending on the particular sedimentary bed through which the vein cuts, but is generally argillitic in composition. Zinc-blende is present in considerable quantity in the ore and there is but little solid galena free from blende.

The vein, which has a width of from 1 to 2 feet, is fairly well mineralized, but, as is customary, the ore runs in shoots and parts of the vein are only slightly mineralized. Where the vein is well mineralized the sulphides are in many places confined to a band of nearly solid mineral (generally mixture of galena and zinc-blende); these bands vary from a few inches up to a foot in width.

The principal value in the ore is in the high silver content, although the lead and zinc contents are appreciable. The following table of assays gives some idea of the values:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz.	Oz.	Per Cent.	Per Cent.
Across 1 foot at lowest showing	Trace.	20.5	Trace.	30.0
Across 18 inches of vein at highest showing on ridge	0.08	30.0	6.0	24.0
Selected ore from ridge	0.06	168.5	24.0	28.0
Selected ore from vein below tunnel	0.06	76.5	22.0	30.0
Selected ore by the owner	0.08	203.4	36.0	20.0

It will be noted that very few average samples were taken. At the present time they are not as important as are samples taken so as to represent hand-sorted ore. It would be quite impossible to ship average grade of ore from such a place as this, with shipment by pack-horses over 30 miles of trail. It is a possibility, however, that carefully hand-sorted ore would stand the transportation charges, and so a number of samples were taken to determine what the selected ore would run.

There is very little work done on the property. A few open-cuts have been made and at an elevation of 6,200 feet a tunnel has been started and faced up. But the vein is naturally exposed at a number of places up and down the mountain-side. Above the tunnel there is a good cropping of the vein on a ridge projecting out from the general slope of the mountain. Above this the vein continues, but is practically inaccessible. The highest showings on the vein contain the best ore, and it is reasonable to expect that a drift-tunnel going in on the vein would show up some good shoots of ore. The silver values in the selected ore make it a reasonable speculation to explore this vein to see whether or not it contains a sufficient quantity of this class of ore to pay to mine it.

About 500 feet north of the silver-lead vein there is another showing on this property known as the "Iron Showing." This is a sheared zone lying only a short distance from where the granite is intrusive into the older rocks. The outcrop runs up and down a steep rock gulch and shows an irregular vein from 2 to 4 feet wide, which is mineralized with arsenopyrite and pyrrhotite. Assays of this material show only traces of gold and an ounce or two of silver to the ton. There are none of the galena-zinc minerals present in this showing. There has apparently been a considerable development of iron minerals in and around the contact of the granite with the older rocks, as there is a considerable "iron-capping," which has evidently been formed by oxidation of original iron sulphides. Oxidation, however, is apparently mainly a surface phenomenon, as the sulphides are always found at or close to the surface.

This property is only about 20 miles distant from the railway, and in the event of the development warranting it, a suitable route for a wagon-road direct to the railway is available down the Suskwa river. A new piece of trail 3 miles in length would cut out the last 6 miles of the present trail. A suitable water-power could be developed on some of the near-by creeks.

O.K. Group. This group of claims is situated at the head of Thoen basin at an elevation of 5,950 feet. It is owned by Henry Thoen and partner. A short distance from the showings and at a lower elevation, at the edge of timber-line, there is a good cabin which serves as a headquarters for the owners of claims in and around the basin.

Interbedded sedimentary and tufaceous rocks make up the formation as exposed on the claims. The showings consist of small stringers which apparently follow the bedding-planes of the sediments and strike along the face of the hill; they lie nearly flat, with a slight dip into the hill. Several cuts and one 30-foot tunnel have been made to develop these showings. Most of the veins are very considerably leached out, so that the filling now consists of iron oxide, together with some lead carbonates. The tunnel cuts through one stringer about 6 inches wide, which is entirely leached and shows no sulphides. Another stringer crops out above the tunnel, but the tunnel has not been driven far enough to crosscut it. This stringer, which is about 10 inches wide, is also leached, but in places shows from 4 to 6 inches of solid galena. A sample of this solid galena assayed: Gold, 0.02 oz.; silver, 190 oz.; lead, 70 per cent. A

sample taken across 10 inches of leached vein-filling returned: Gold, 0.02 oz.; silver, 80 oz.; lead, 36 per cent.

The veins on this property show a nice quality of silver-lead ore and it is to be hoped that development will show appreciable sized ore-shoots of this kind of ore.

Babine. This claim is situated about 2 miles westerly from Thoen basin on a steep bare mountain-side at an elevation of 5,750 feet. The showing consists of a small vein occurring in quartzite striking north-east (mag.) and dipping at 65° to the north-west. The vein is from 6 to 8 inches wide and the filling is mainly arsenopyrite, together with some quartz. Average samples show that this arsenical iron carries from $5 to $12 a ton in gold values and 1 to 3 oz. of silver.

Boulder Creek.

Boulder creek rises in unnamed mountains lying to the south of Rocher Déboulé mountain and flows easterly to the Bulkley river, joining that river not far from Seaton Station, on the Grand Trunk Pacific Railway. The creek is about 12 miles in length and has a fairly rapid rise, as its head is in a basin at timber-line, while the elevation at Seaton is 1,280 feet. Claims were staked at the head of this creek some years ago, but most of them had been allowed to lapse. Very little prospecting or work of any kind has been done on the creek for some years.

Sultana Group. This group consists of four claims—the *Sultana*, *Sultan*, *Mugwump*, and *Dolores*—and is owned by A. R. Macdonald and Joseph S. Hicks. It is situated on the east side of the basin at the head of the South fork of Boulder creek. This basin is a large one, with terraced benches rising upwards. The showings are at an elevation of 5,300 feet on a flat bench well above timber-line. The rock formation at this point is a typical coarse-grained granodiorite which is intrusive into older volcanic measures. The surface outcrop of the ore-body is an iron-capping and at the present stage of development the nature of the ore-body is not clearly apparent. When the writer examined the property there was a certain amount of old snow covering the ground and it was rather difficult to size up the showing.

The ore-body may be a definite vein or sheared zone in the granodiorite or it may be of some other nature. A large open-cut 30 feet long and 12 feet deep at one end apparently crosscuts the line of strike of the ore-body, and if so, then the ore-body is of considerable size. It is possible that the ore is developed at the intersection of cross-fissures and that at this point there is a large lens of ore.

The sulphide minerals present in the ore-body are pyrite, tetrahedrite, and small amounts of galena and chalcopyrite; a few specks of molybdenite were also noted. The pyrite is present in considerable quantity and some of it may be arsenopyrite. The surface of the deposit is turned into a typical iron-capping by the oxidation of the iron sulphides, with a plentiful distribution of iron oxide scattered through decomposed granitic rock-matter. There is not any great development of quartz in the deposit, the gangue consisting mainly of somewhat altered granite.

Surprisingly good values were obtained in the samples taken by the writer, as is shown by the following list:—

Description.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Across 8 feet near upper end of cut	0.02	29.0	1.7
Across 10 feet continuing down cut from first sample	0.06	59.0	5.2
Selected ore from two bands of sulphide in the cut	0.10	86.0	13.2
Selected ore showing grey-copper	0.06	112.0	16.0
Grab sample from dump from small cut 50 feet south-west of big cut	0.01	31.5	3.7

Lying south-west of the big open-cut there is a small hole which is supposed to prospect a continuation of the vein in that direction. This hole was full of snow, but it was apparent from the dump that most of the rock taken out in digging the hole was well mineralized and the grab sample taken showed it to be good ore.

This property has been staked for some years, but apparently very little work has been done on it. In 1920 the present owners of the property obtained trail permit for assessment-work and improved the trail going up Boulder creek. This year they did the assessment-work and tried to trace the vein on the surface. They succeeded in finding indications at a point several hundred feet to the north. The granitic rock at this point is stained with iron oxide and this may be the iron-capping lying above the vein.

The silver values in the ore are apparently mainly associated with the grey-copper. No assays were made for lead as the galena content is negligible.

This property has a very promising surface showing, and if the ore-body is continuous in length with the width and values shown in the big open-cut it may prove to be a very important find. The owners intend to do considerable development-work next year. In the meantime, however, the property may be an attractive one to some of the scouting engineers that are looking for promising prospects.

The situation of this property is a favourable one. The ore could be handled nicely by a short tram down to a point on Boulder creek, from which a good wagon-road on an easy grade could be made to the railway. The length of this road would probably not exceed 10 miles. There is plenty of timber for mining purposes close to the property and on Boulder creek and its branches a certain amount of water-power is available.

This locality is one which warrants much further prospecting than it has been given. Some years ago the country lying between Rocher Déboulé and Hudson Bay mountains was roughly prospected, but much of it was never even gone over and in recent years no prospectors have been in to it. The country is mountainous, with several creeks rising in the mountains and flowing easterly to the Bulkley river, such as Porphyry, Boulder, and Gramaphone creeks. The rock formations exposed are mainly Hazelton formation (sediments and volcanics) intruded by granites, granodiorites, and porphyries. Such geologic conditions are favourable for the occurrence of mineral-bearing deposits. Prospectors are therefore advised to consider the possibilities of this section.

Telkwa Section.

Babine-Bonanza Mining and Milling Co.

The property of this company, which is situated on the Babine Lake slope of the Driftwood Creek divide, has been under development for a number of years. The control of the company is held by James Cronin, who has actively directed the development-work. The property has been described at length in previous Annual Reports, so that the history of the early development need not be given here. Steady development of the property was again carried out during the season, a gang of about ten men being employed all summer and until late in the fall, when weather conditions became bad. The mineral-showings on this property consist of several quartz-filled fissure-veins and a contact ore-body lying between rhyolite porphyry and a black schist. The valuable minerals contained in the ore-bodies are galena, zinc-blende, and small amounts of pyrite, arsenopyrite, and tetrahedrite. In the veins the gangue is principally quartz, while in the contact ore-body there is, in addition to quartz, altered rhyolite intimately associated with the metallic minerals. Shoots of nearly solid galena and also of zinc-blende occur in all the ore-bodies, besides which there is much disseminated rock-matter carrying sulphides, which varies in value all the way from slightly mineralized rock to high-grade mill-feed.

The upper workings consist of a number of shafts and tunnels which develop certain veins and the contact ore-body down to a depth of from 150 to 200 feet. In 1919 a lower crosscut tunnel, No. 2, 225 feet below No. 1 tunnel, was started and was driven in to cut the main contact ore-body, which was accomplished in 1920.

The following information concerning the operations this year has been supplied by the company: "The chief result was the ascertaining for a certainty which of the bodies of ore found in the lowest level (No. 2 tunnel) last year constituted the main vein. When work was stopped last year there remained indications that the main vein might lie beyond the point to which this tunnel was driven up to December, 1920. This year, therefore the main tunnel was continued some distance as a crosscut through the formation which lies parallel to the main vein. A number of mineralized seams were encountered, the best at 90 feet, showing 6 to 8 inches of clean galena. Work was started later in the Junction drift, and shortly after starting a distinct improvement in that vein confirmed the belief that it is the main vein. The reason this vein in the Junction drift improved so steadily in the portion of the drift run this summer

must be attributed to getting away from the disturbed condition at the junction of this vein and the East and West veins. It is to be regretted that it was not possible to extend the work in the Junction drift to a point under the large ore-shoots on the upper levels. It would be only reasonable to expect a very good showing in view of the marked improvement in other features on this level."

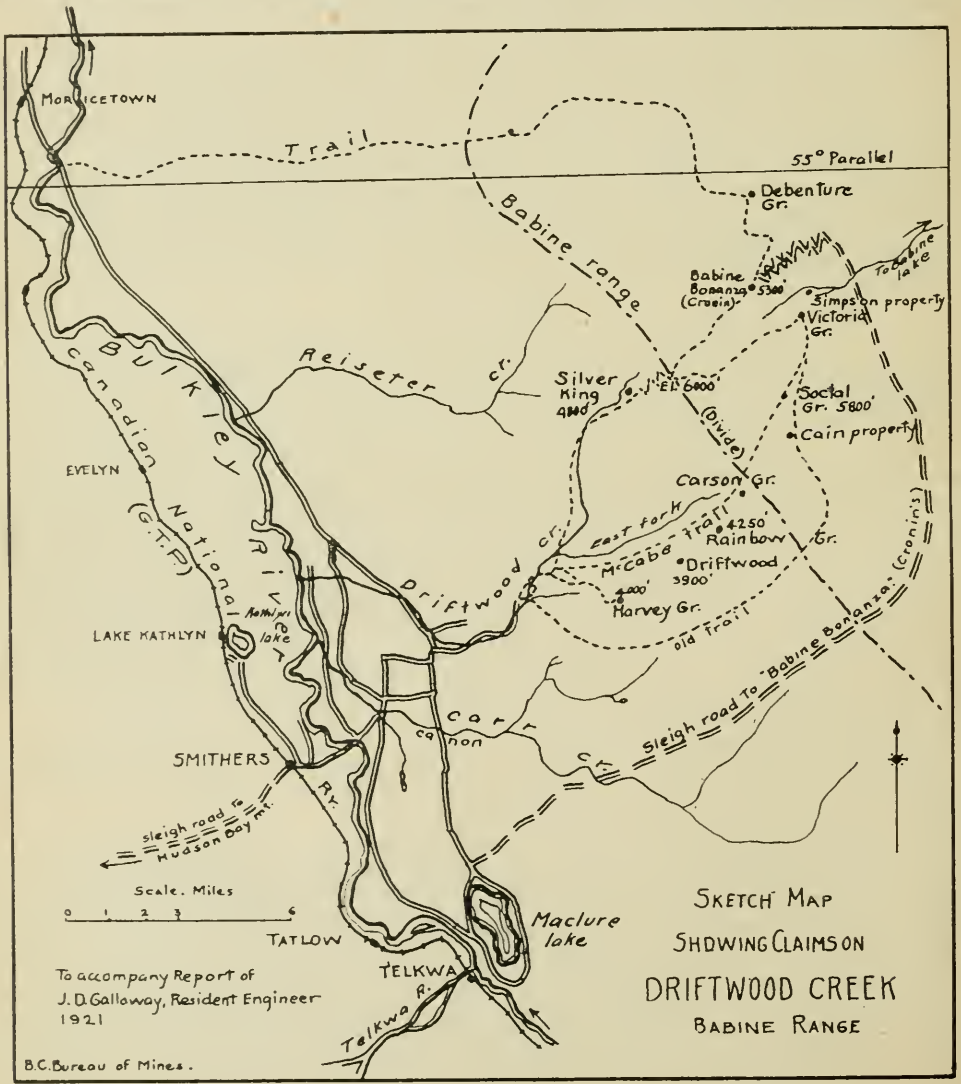
As the ore developed in this tunnel is from 400 to 450 feet below the surface outcrops, there is therefore a considerable tonnage of probable ore developed in the mine. A raise through to the No. 1 tunnel would give interesting information regarding the continuity of the ore-shoots. It is apparent that this property is about ready to be equipped with machinery and a mill so as to commence its productive stage.

Driftwood Creek.

Rainbow Group.

This group of claims, owned by J. S. Kelly, S. Gazely, and R. Macklin, is situated on the east side of Driftwood creek, about 15 miles from Smithers.

There is a wagon-road to within about 3 miles of the property and then a good trail that goes within half a mile of the showings. At an elevation of 4,250 feet the vein is



exposed, striking S. 55° W., angling along the hillside, with a dip of about 60° to the south-east or into the hill. The country-rock is red andesite and the vein is of the sheared-zone type with indefinite walls. The metallic minerals occurring in the vein are chalcopyrite, tetrahedrite, and a little chalcocite. The gangue is altered wall-rock, together with some calcite and siderite. At the time of examining the property a large open-cut had been made on the showing, and this exposed a width of mineralization of from 4 to 5 feet. The actual width of the vein may be more or less, as no well-defined walls were in evidence. A sample was cut across 4½ feet of the vein at this point, which returned on assay: Gold, trace; silver, 13.6 oz.; copper, 5.4 per cent. A selected sample assayed: Gold, trace; silver, 71 oz.; copper, 4.2 per cent.

No further work had been done to expose the vein at different points along the strike, but during the summer the owner has put in a good deal of time prospecting the property. He reports that he has now an excellent showing. This would seem to be a vein that warranted further exploration.

Driftwood Creek.

This claim was worked during the early spring by a Smithers syndicate, the work being under the supervision of J. J. Driscoll. The claim lies to the south of the *Rainbow* group (described above). At an elevation of 3,900 feet a tunnel has been driven in 25 feet on a small quartz vein, which is well mineralized with chalcopyrite and chalcocite. Fifty feet below the upper tunnel another tunnel has been driven 75 feet, the first 35 feet of which is a crosscut and the last 40 feet a drift on the vein. Apparently this is the same vein as exposed in the upper tunnel. A selected sample taken from the dump (containing about 3 tons) at the mouth of this tunnel assayed: Gold, 0.04 oz.; silver, 47.5 oz.; copper, 14.5 per cent.

Lower down the hill there are mineralized outcrops on which little or no work has been done. One of these is from 2 to 4 feet wide and is mineralized with the usual copper minerals. It is apparently worth development.

Harvey Group.

This property, which is situated on Driftwood creek, 12 miles from Smithers, has been taken under lease and bond by an Edmonton syndicate. Work was started in the spring and a crosscut tunnel commenced. This was driven 170 feet, but in that distance had not reached the vein. From a consideration of the flat dip of the vein, it was hardly to be expected that the vein would be cut before going at least 200 feet. For reasons which are not known, the syndicate stopped work, but the option is still retained.

The showings on this property have been described in previous Annual Reports. The principal values in the ore are in silver, with a little copper. The veins, which are from 4 to 8 feet wide, are of the sheared-zone type and carry tetrahedrite, chalcopyrite, and chalcocite in a gangue of altered wall-rock.

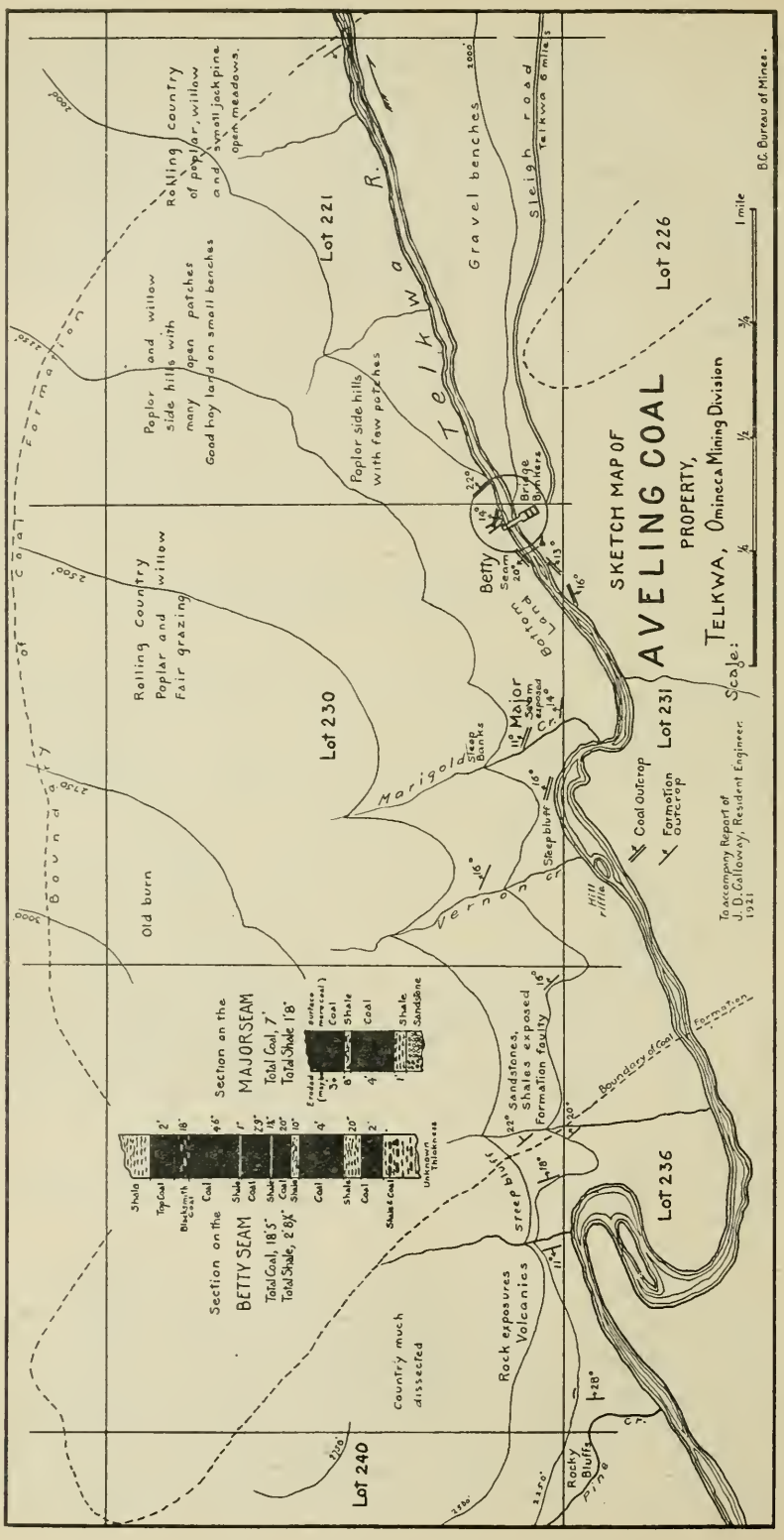
Silver King Group.

This property is situated at the head of Driftwood creek and is owned by Patrick J. Higgins. Last year this property was under bond to a local syndicate, but their option has now lapsed. The owner commenced a crosscut tunnel this year to tap the vein at some depth below the present drift-tunnel. The showing consists of a quartz vein carrying tetrahedrite, some native silver, and subsidiary amounts of copper-iron sulphides. The principal value is silver and some very nice assays have been obtained. The vein, which is from 6 inches to 2 feet wide, is developed by a drift-tunnel 100 feet in length.

Other Properties.—Other properties in this part of the Babine range on which the owners did work during the year were the *Victoria* group, Martin Kane's property, Simpson property, and Carson property.

Aveling Coal Property.

This property is situated on the north side of the Telkwa river, 7½ miles above the town of Telkwa. It is owned by Major Aveling and partners and Rattenbury Lands, Limited. About the end of 1920 a five-year lease on the property was obtained by Gillespie & Wilson, who formerly had been operating the property of the Telkwa Collieries under lease. The mine is connected with the shipping-point of Telkwa by wagon-road, but considerable repairs and improvements are needed on this road before it can be classed as a first-class road. At present this road is quite suitable for winter haulage on sleighs, but would require a further expenditure to make it suitable for tractor-haulage. During the year some improvements to the road were made, including a bridge across Mud creek, which was built by the Government.


SKETCH MAP OF
AVELING COAL
PROPERTY,
Omineca Mining Division
TELKWA, B.C.
Scale: 1 mile
To accompany Report of J.D. Galloway, Resident Engineer 1921
B.C. Bureau of Mines.
Lot 226
Lot 231
Lot 230
Lot 221
Lot 236
Lot 240
Telkwa River
Gravel benches
Sleigh road
Telkwa 6 miles
Bridge Bunkers
Betty Seam
Major Seam
Boundary of Coal Formation
Coal Outcrop
Formation Outcrop
Steep Bluff
Hill rifle
Marigold
Steep Banks
Old burn
Rolling Country
Poplar and willow
Fair grazing
Poplar side hills with few patches
Poplar and willow side hills with many open patches
Good hay land on small benches
Rolling country of poplar, willow and small jack pine open meadows.
Country much dissected
Rock exposures Volcanics
Sandstones, Shales exposed Formation faulty
Rocky Bluffs
Section on the MAJOR SEAM
Total Coal, 7'
Total Shale 18"
Section on the BETTY SEAM
Total Coal, 18.5'
Total Shale, 2.83'
Shale
Top Coal
Bone
Bottom Coal
Sandstone
Unknown Thickness

Gillespie & Wilson commenced work on the property about the end of 1920 and for some months carried on development-work and made some shipments of coal. During the summer of 1921 the property was equipped with camp buildings, bunkers, and a bridge across the Telkwa river. This bridge has rails laid on it and connects with the coal tunnel, which is right on the north bank of the Telkwa river. The bunkers are on the south side of the river and the coal is trammed from the workings across the bridge to the bunkers. Shipping of coal was recommenced in the fall, but owing to bad weather and the poor condition of the road not much was accomplished until sufficient snow came for sleighing. During the month of December from 10 to 15 tons a day was shipped.

The various coal-basins on the Telkwa, Zymoetz, Bulkley, Skeena, and Kispiox rivers were all examined and reported on by W. W. Leach, of the Geological Survey of Canada, some years ago. These reports were published in the Summary Reports of the Geological Survey, 1905 to 1910, and in a bulletin entitled "The Telkwa River and Vicinity." Accompanying this bulletin is a topographic map of the Telkwa River area.

According to Leach, a number of these coal-basins hold out some promise of containing considerable tonnages of good-grade coal, while others are too small or broken up or the coal is rather high in ash content. Many of these basins represent fragments of extensive coalfields, the greater portions of which have been removed by erosion.

The geologic age of these coal-measures is placed as being Lower Cretaceous, the whole series of coal-bearing beds being known as the Skeena formation. Throughout the formation the coal may be classed as bituminous, although in places it is a high-carbon bituminous coal. Generally speaking, the coal wherever found in the Skeena formation is of good quality, except where a high ash content renders it unsuitable as a fuel. Some seams contain coking-coal, while others are non-coking.

The coal cropping on the bank of the Telkwa river on the Aveling property is known as the Betty seam, and as at present known is the most important showing on the property. There are other seams cropping which are promising, but as yet no development has been done on them; one of these is known as the Major seam, which is exposed about half a mile away from the Betty seam.

Development of the Betty seam consists of two tunnels driven in on the coal, the longest being about 100 feet in length. These tunnels are only a short distance apart, and now the taking-out of coal has connected them and opened up rooms between. The seam strikes N. 50° W. (mag.) and dips at about 14° to the north-east. By this dip the coal is rising slightly going up-stream, but the indications of coal farther up the river would indicate that the dip changes. Going northerly from the coal-outcrop there is some flat land on the river-bank, but in a short distance the ground rises in a series of benches to form a high hill.

The Betty coal-seam is exposed along the bank of the river for a few hundred feet, but is not positively identified elsewhere. The development so far is limited to the short distance proven by the tunnels, as no drilling or other deep development has been carried out. The Telkwa geologic map-sheet by W. W. Leach (Geological Survey of Canada) includes this area, and this map shows that at this point there is an area of from 3 to 4 square miles of coal formation. The position of the Betty seam and the topography of the ground would indicate that the seam would be likely to be continuous throughout a considerable portion of this coal formation. If so, then there is quite a large tonnage of coal in this property. It would be useless to give any estimate of the coal in the field at the present time and until some development-work is done. The indications are such however, that the property will warrant extended development.

Accompanying this report is a sketch-map (copy of map by F. B. Chettleburgh) and sections of the Betty and Major seams. From these sections it will be seen that there is over 18 feet of coal in the Betty seam, practically all of which could be mined free of shale and waste material. At the present time a band of coal 2 feet thick is left for the roof, as it makes a better roof than the soft friable shales. Below this top coal there is an 18-inch band of coal that is being sold as blacksmith-coal. Two main bands of coal are being worked at the present time, the top one being 6 feet thick and the bottom one 4 feet. There is coal above and below these bands and they are separated by about 4 feet of coal, in which there are some shale-bands.

The coal is of an excellent quality, as will be seen from the following table of analyses:—

Description.	Moisture.	Vol. Com. Matter.	Fixed Carbon.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Sample across 18 inches, blacksmith coal	1.8	31.0	63.6	3.6
Sample across 4 feet 6 inches right below 18-inch band	2.6	24.8	68.1	4.5
Sample across same 4-foot 6-inch band at another place	2.4	25.1	67.6	4.9
Sample across 4-foot band at bottom of seam	2.2	22.7	68.2	6.9
Sample across same 4-foot band at another place	2.0	22.8	67.8	7.4
Grab sample from coal-bunkers	1.8	26.4	65.9	5.9
Average of above analyses	2.1	25.5	66.9	5.5

By applying Dowling's Split Volatile Ratio to the above average analysis, the coal would be classed as a bituminous coal, but lies very close to the classification of high-carbon bituminous coal. The moisture content of these samples is probably slightly higher than will be found in the coal when at some distance from the surface. One noteworthy feature of this coal is the low ash content, which is considerably lower than that of most coals now being sold in British Columbia. It is evident from the above analyses that this coal will prove very satisfactory as a steam-coal and will also be a desirable domestic fuel. The coal has also had a fair trial in the local market and at Prince Rupert and is giving satisfaction everywhere.

About the end of the year a fault was struck in driving ahead the main tunnel and work was stopped at this point. An examination of the fault shows that it is apparently a normal fault caused by the outcropping measures slipping downhill towards the river. Such minor faults are to be expected and no difficulty should be experienced in picking up the coal again. At the present time, however, the lessees prefer to get out coal for shipment rather than to do development. When the roads get bad in the spring there will be a time that it will be impossible to haul coal and development will be resumed.

The opening-up of this coal property would be expedited by diamond-drilling and, if the results were satisfactory, the building of a branch railway from Telkwa. No such plans are, however, being considered. The lessees intend to mine coal and ship by wagon, sleigh, or tractor haulage, and to gradually develop the mine by advancing the tunnels. A good market for this coal is available at Prince Rupert, and if a better road had been made to the mine this summer a much larger tonnage of coal would have been shipped. The cost of hauling over a poor road for 7 miles leaves but little margin for mining the coal. However, it is expected that with good sleighing conditions this winter steady shipments will be made. As the lease held by Gillespie & Wilson can be terminated at any time on thirty days' notice in the event of the property being sold, there is not much inducement to them to make any heavy capital investment in road or other improvements or development.

The quality of this coal and the price that Gillespie & Wilson quote for it laid down f.o.b. the railway-cars at Telkwa is such that this coal can compete very successfully with Vancouver Island or Alberta coal. As yet, of course, the amount sent to Prince Rupert has been insignificant, but still the coal-dealers of that city are very anxious to secure a steady supply of it. It is apparent that if this coal can be mined and hauled over 7 miles of indifferent wagon-road and sold at a profit there are great possibilities for the property if opened up and equipped for large-scale mining and provided with railway transportation. In addition, a plentiful supply of good coal at a reasonable price would have a stimulating effect on all Northern British Columbia. The shipment from this mine for the year was 800 tons.

Other Coal Properties.

For detail descriptions of the Zymoetz River coalfield, Jefferson-Dockrill coalfield, Telkwa Collieries property, and others, *see* the Annual Reports of the Minister of Mines from 1914 to 1920.

Hudson Bay Mountain.

There has not been a great deal of mining activity on Hudson Bay mountain during the year 1921. The usual annual assessment-work and small-scale development-work were carried out by the owners on a number of properties.

Mamie Group.

About the beginning of December J. R. Turner returned to Smithers to resume operations on the *Mamie* group. This property is owned by J. Aldrich and in 1919 a bond on it was obtained by J. R. Turner, acting for a Seattle syndicate. Work was commenced late in 1919 and continued until about March, of 1920. Mr. Turner then left and apparently the bond lapsed through non-fulfilment of the conditions. On returning in December of this year Mr. Turner arranged an extension of the bond in a manner satisfactory to himself and Mr. Aldrich. Work was started shortly before Christmas with a crew of half a dozen men and will be continued all winter.

The property is situated on the southern slope of Hudson Bay mountain and is connected with Smithers by a sleigh-road 12 miles long. This road can be used for light wagons in the summer-time. If necessary, it can be easily improved into a good road for hauling ore or concentrates.

The showing on the property consists of a well-defined vein averaging from 4 to 5 feet in width and mineralized with zinc-blende, arsenopyrite, and in places a little galena. The development consists of surface cuts and an 18-foot shaft and a drift-tunnel driven by J. R. Turner in 1919–20. The present work is to continue this drift-tunnel, which is in about 125 feet, and also to sink at some place a winze from this drift.

Good gold values are reported from assays of the ore, besides which there is a considerable zinc content. At the end of the year it was reported that the development was proceeding favourably.

Oil.

What might be described as an "oil boom" has arrived in Northern British Columbia, and much interest is being taken in the question of possible oil-producing regions existing at different points. Up to the present time local people have been the pioneers in the different places which have been considered, but the attention of outside interests has been attracted and several "oil scouts" have made preliminary examinations.

The Kitsumgallum valley, which stretches northerly from Terrace, a town on the Grand Trunk Pacific Railway, was the scene of the first activity. This lies in the North-western Mineral Survey District, just a few miles west of the boundary-line between that district and the North-eastern District. As the area lies in Mr. Clothier's district the writer did not examine the field. The first leases in the field were acquired by C. F. Schaub, who turned them over to the Kitsumgallum Basin Petroleum Company. Up to the present time the energies of this company have been devoted almost entirely to an extensive stock-selling campaign.

Burns Lake.—At Burns Lake a local syndicate headed by D. Gerow has been actively engaged in looking into the oil possibilities of that area. The first leases were staked by Mr. Gerow on the south shore of Burns lake; later leases were staked by Arthur Wood around Francois lake, which lies 14 miles south of Burns lake, and now a large number of leases have been applied for in the Burns Lake–Francois Lake section generally.

Drilling operations were started by the Gerow syndicate during the summer with a light water-well drilling rig driven by horse-power. Before long the use of horses was given up and a 6-horse-power gas-engine was used to drive the drill. The site chosen for the drill is about 100 yards from the edge of the lake and directly opposite the town of Burns Lake (south shore of the lake). To begin with, a 4-inch casing was used, but this apparently proved unsatisfactory, as after getting down some 40 feet in the surface wash the hole was abandoned. It was decided not to resume drilling until a supply of 10-inch casing was secured. Pending the arrival of this casing an attempt is being made to sink a shaft through the surface gravels and clays to bed-rock. The depth of the surface wash covering bed-rock is not known, but it may be considerable.

Vicinity of Hazelton.—Late in the fall a large number of oil leases were staked in the Skeena and Kispiox valleys, starting from about 10 miles north of Hazelton and reaching up to the Second Cabin, a distance of some 50 miles from Hazelton. Practically all of these leases have been applied for by Hazelton people. During the first week in November an attempt was made by an oil geologist from Edmonton to examine the ground, but owing to snow it was impossible to see much. It is expected that a complete examination of the field will be made next summer.

Discussion.—Before considering the geologic evidence regarding the possibility of oil in this district generally, it will be well to state briefly the usually accepted criteria which are con-

sidered as indicating a possible oilfield. First of all, three fundamental requirements must be filled, which are: (1) A sedimentary formation which at the time of its deposition contained sufficient animal or vegetable life (or both) to be a source of oil in appreciable quantities; (2) a rock formation which is sufficiently porous to act as a reservoir for the oil; (3) a rock formation which is sufficiently impervious to liquids to act as a seal to hold the oil in its reservoir and prevent its escape to the surface.

Given these prerequisites, then comes a consideration of the possible field as regards structure, which is determined by detail geologic mapping, and this information as to structure determines the most favourable places for drilling.

A definite seepage of crude oil is evidence that the underlying rock formations contain oil.

The rock formations which have been recognized in the country stretching from Hazelton to the Francois Lake-Burns Lake section in descending time-order are:—

Quaternary	Superficial deposits	Sand, gravel, clay, etc.
Tertiary	Volcanic rocks and possibly small amounts of sediments	Principally olivine basalt, but including other volcanics, sandstones, and shales.
Jurassic to Post-Lower Cretaceous	Coast Range batholithic rocks	Granite, granodiorite, diorite, and porphyritic rocks.
Lower Cretaceous	Skeena formation	Sandstones, conglomerates, shales, and coal-seams.
Upper Jurassic to Lower Cretaceous(?)	Hazelton formation	Sedimentary, volcanic, and tufaceous rocks. Sometimes volcanics and sediments separate and sometimes interbedded and intercalated.

The above formations have been studied and in places mapped by the following officers of the Geological Survey: Dawson, McConnell, Leach, Malloch, MacKenzie, and O'Neill. It is, of course, possible that in this large expanse of country other formations will yet be identified, but for the present the only known formations are the above-mentioned ones.

The sedimentary measures in the above list are those of the Tertiary, Skeena formation and Hazelton formation. The Tertiary sediments are negligible in quantity and so need not be further considered.

The Skeena formation is the coal-bearing series of the Telkwa, Morice, Zymoetz, Bulkley, Skeena, and Kispiox valleys and of the Groundhog coalfield. It is believed to be, at least in part, conformable with the underlying Hazelton formation and is generally placed as being of Lower Cretaceous age, although fossil evidence is by no means as satisfactory as is desirable. Inasmuch as this formation is coal-bearing and as no horizons yielding a great abundance of marine fossils have been found in it, the conclusion must be that it is not a highly promising formation in which to expect that oil in commercial quantities has been formed.

The Hazelton formation has a very widespread occurrence throughout the district and undoubtedly enormous thicknesses of these rocks exist at different places. This formation, which consists of sedimentary, volcanic and tufaceous rocks, is as a rule more or less metamorphosed. It has apparently suffered some regional metamorphism, and in addition, where in close proximity to the intrusive Coast Range batholithic rocks, has undergone extreme local metamorphism. The age of this formation is doubtful, but the evidence would seem to indicate an age ranging from Upper Jurassic to Lower Cretaceous.

The sedimentary measures of the Hazelton formation are in part interbedded with the volcanic members and ash rocks, but in places there are considerable thicknesses of sediments with the volcanics entirely missing. These sediments consist of sandstones and shales, but in places they are so metamorphosed as to be quartzite, argillites, slates, etc. Plant remains are plentiful in places in these measures, but as yet no horizon containing an abundance of marine fossils has been discovered. The absence of well-preserved marine fossils throughout the Hazelton formation is conclusively shown by the inability of the officers of the Geological Survey to obtain definite fossil evidence of the exact age of this information. In this connection, however, it must be remembered that detail geologic work has only been done in certain small parts of the area under discussion. In the great thicknesses of the sedimentary members of the Hazelton formation there may well be highly fossiliferous horizons which have not yet been observed.

In the immediate vicinity of Burns lake rock-exposures are somewhat scattered, as a great deal of the surface is covered by soil, clay, etc. The rocks that are exposed would seem to be mainly Hazelton formation, with a considerable percentage of intrusive rocks in the form of dykes or stocks which may or may not also belong to this formation. The rocks believed to be Hazelton formation rocks are volcanics, tufaceous rocks, argillites, and possibly some sandstones.

In the vicinity of Francois lake Dawson classified the formations exposed as belonging to the Porphyrite series. This name described a series of dominantly volcanic rocks which form the lower horizon of the Hazelton formation. The name "Hazelton formation" was applied by Leach to replace Dawson's "Porphyrite group," the name to include the whole conformable series of volcanics and sediments.

Reviewing the available literature regarding the Burns Lake-Francois Lake area, it would seem that the rock formations of this area are mainly volcanic and tufaceous measures, with some metamorphic sediments—not a promising area, therefore, for oil prospecting.

In this connection it may be pointed out that one supposed evidence of oil in this area, which has locally been supposed to be of importance, consists of gas-bubbles rising around the shores of Burns, Francois, and other smaller lakes. It is fairly evident, however, that this gas is only marsh-gas arising from the decaying vegetation such as can be seen around almost any swamp. Thin films of iridescent iron oxide and traces of vegetable-oil on swamps similarly are not evidence of underlying oil reservoirs.

An excellent reconnaissance report on the country lying between Hazelton and the Groundhog coalfield is contained in G. S. Malloch's report on the Groundhog field in the 1912 Summary Report of the Geological Survey. From this report it is apparent that the Hazelton formation is practically continuous from Hazelton to the Groundhog coalfield, and that in places, particularly in the coalfield, it is conformably overlain by the Skeena coal-bearing series. Going northerly from Hazelton, the volcanic flows of the Hazelton formation gradually disappear, giving way to tufaceous rocks, and finally these fade out and the formation consists almost entirely of sedimentary measures. Plant remains are abundant throughout the formation and a marine horizon yielding poorly preserved fossils was recognized near the base of the upper third of the formation. Quoting from the report: "The top of the Hazelton formation in the measured section consists of grey shales with larger grains of black shaly material and often divided by thin lines of bituminous matter parallel to the bedding-planes; shales predominate throughout, and no great amount of tufaceous material is present except at the base of the section, which ended with a bed of tufaceous sandstone 40 feet thick."

From the foregoing it is apparent that in the country lying north of Hazelton to the Groundhog coalfield there is a large area of sedimentary rocks, but the question of whether or not these rocks contain any horizons which would be probable sources of oil awaits more detail examination.

For the present the question of a source of oil in the rocks of this district is the important one, as the considerations of suitable reservoir and cap-rocks are of secondary importance. It is probable, however, that such suitable containing horizons would be found. Anticlinal and dome structures are, of course, frequently observed in the formations of this district, as the mountain-building forces have produced much folding and also faulting of the measures.

So far as is known, no definite seepages of crude oil have been found anywhere throughout the district.

Fraser Lake Section.

Fraser Lake Coal.

The occurrence of coal of a lignitic variety along the southern shore of Fraser lake has been known for many years. In the summer of 1920 a number of coal leases were staked by T. J. Kettyle, covering some coal-outcrops about 2 miles from the eastern end of Fraser lake and situated close to the edge of the lake on the southern side. Owing to the coal reserve in force at that time these leases were not secured at once, but it is believed that they are now granted. A company known as the Fraser Lake Collieries, Limited, was formed to take over these leases, and some development was carried out last year and the first part of 1921. The stock of the company was subscribed for locally by residents of Endako, Fort Fraser, and other towns in the district. Mr. Kettyle has been in charge of the preliminary work of the company.

The coal formation consists of shales, some sandstone, and thin bands of lignite separated by shale-partings of varying thickness. The whole formation appears soft and crumbly and from its general appearance looks like a comparatively recent one. The bands of lignite vary from a few inches up to 2 feet in thickness, but in places there is from 4 to 5 feet of coal and shale bands bedded together.

Three shafts have been sunk, which are 28, 38, and 12 feet deep. The first two shafts pass through coal-bearing strata in which there are alternate bands of coal and black shale. The third shaft has not yet reached any coal-bands. The best section of coal which was seen in the shafts was 5 feet, of which 13 inches was shale occurring in four bands.

The following samples were taken:—

Description.	Moisture.	Vol. Com. Matter.	Fixed Carbon.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Across 5 feet of coal-seam, excluding 13 inches of shale	13.7	29.8	29.8	26.7
Grab sample from dump, No. 1 shaft	17.2	36.9	34.2	11.7
Grab sample from dump, No. 2 shaft	5.1	19.7	49.8	25.4

The area of coal formation exposed at this point is apparently not extensive. The railway closely parallels the lake-shore at this point and affords a good section of the formation in a number of rock-cuts. The coal-outcroppings are only a few hundred feet from the railway. To the west of the coal formation a short distance a rock-cut on the railway shows a massive granitic rock, while to the east of the showings there are basaltic dykes making intrusive contacts with the sedimentary formation. Still farther east volcanic ash and tufaceous rocks come in. The actual area of coal formation that can be seen is quite small, although the field may have an extension to the south—that is, away from the lake.

The property was examined in August and it is not known if further development has been carried out since that time. If development of the property is to be carried out, the first thing that should be done is to make a thorough geologic examination of the surface to see if the possible coal area is sufficient to justify underground development. The analyses of the coal show that on the average it would be classed as a lignite, and, further, that the percentage of ash is somewhat high.

Iron-ore Showings South of Vanderhoof.

An occurrence of hæmatite-iron ore, which had been reported to be of some importance, in the vicinity of Finger lake was examined during the field season. It is to be regretted that the size of the deposit was found to be much smaller than had been expected and that the showings are not particularly promising. The showings are situated on a small hill on the north side of Finger lake and are distant about 40 miles from Vanderhoof. The present route into this section is somewhat roundabout and consists of about 20 miles of road and about 30 miles of trail, the last 10 of which is a very indifferent one. The country is of the plateau type characteristic of the Nechako plateau. The rock formations as noted on the trail going into Finger lake are almost entirely igneous, a considerable percentage being volcanic rocks. The occurrence of iron ore, although not promising in itself, is of such a nature as to indicate that this section may have possibilities for the prospector in looking for other minerals than iron. Briefly, the iron ore occurs as hæmatite and specularite in sheared zones and is an example of the type of magmatically deposited mineral occurrence, to which type it is now almost universally agreed that most of our sulphide ore-bodies belong. Hæmatite and specularite are minerals which have been deposited under fairly high temperature and pressure conditions from aqueous and gaseous solutions. Such solutions would very possibly carry sulphides, such as galena, zinc-blende, chalcopyrite, and pyrite, which minerals would be deposited under lower temperature and pressure conditions than the iron minerals. Somewhere in the vicinity of these iron occurrences, therefore, there is a possibility of there being other mineral-deposits.

The *Iron Mountain* group of mineral claims has been located to include these iron-showings; the claims are owned by Joseph Murray, R. C. McCorkell, George Ogston, Ernie Mitchell, J. G. Watt, and Hugh Wilson. The elevation of the top of Iron mountain, which is the local name

applied to the hill on which the iron-showings occur, is 4,000 feet, while the elevation of Finger lake is 3,000 feet.

The rock formations exposed on Iron mountain consist entirely of volcanic rocks, the principal types being felsite, diabase, and andesite. These rocks are in part porphyritic and in places consist of volcanic breccias.

Sheared and sheeted zones have been developed along certain lines in these rocks, the line of strike varying from north and south to east and west. In these zones small stringers and bunches of hæmatite have been deposited, apparently by replacement action. The stringers of solid hæmatite are only a few inches wide, and in addition there is a certain amount of disseminated ore. This material, which forms a typical ore breccia, occurs in widths up to 2 to 3 feet, but is not continuous for any great length. The only other mineral seen besides hæmatite and specularite was in one place some minute cubes of pyrite. Surface cuts have been made in many places over the hill, but the general nature of the iron-showings is much the same wherever it is exposed.

The pure solid hæmatite is good-grade iron ore and free from impurities. The brecciated ore is low grade from admixture of felsitic rock and will run from 20 to 30 per cent. iron. Unless very much larger bodies of the solid hæmatite are found by further development the deposit is not of commercial importance at the present time.

The discovery of this iron was made by Joseph Murray and he has put in a good deal of time in digging holes to uncover the showings. Mr. Murray has a good cabin near the foot of Iron mountain, at the edge of the lake, and usually spends the winter in trapping in this district.

CARIBOO MINING DIVISION.

It is pleasing to be able to report that in the old Cariboo District (which includes the Cariboo and Quesnel Mining Divisions) there was no cessation of mining activity during the year 1921, and contrary to most mining districts throughout North America, an increased production was made as compared with the preceding year. The chief reason for this is that the main product of mining operations in the Cariboo is gold, and during 1921 the onerous conditions which militated against the gold-miner during the war years began to be somewhat alleviated. The result was that renewed interest in gold-mining has taken place, especially as the depressed market prices of other metals tended to discourage the mining of these metals. The full effect of lowering prices and general costs has not yet been manifested in the Cariboo District, so that it is reasonable to expect that during 1922 a further increase of production from this district will take place.

The mineral production of the Cariboo District up to the present time has consisted almost entirely of placer gold. From time to time during the last forty years efforts have been made to mine some of the quartz veins, which are very numerous in different parts of the district. While some gold has been produced in this way, none of the attempts at lode-mining have been successful in producing a mine which has continued in operation for long. Rich pockets of gold quartz have been taken out, but no continuous operation has resulted. It would appear that now is a favourable time for a reconsideration of the possibilities of some of these properties. Wages and other costs are reasonable and railway transportation is much closer than in former years. During the summer the Pacific Great Eastern Railway was completed to Quesnel and steel is laid some 18 miles northerly towards Prince George.

One of the important events of the year in this district was the reopening of the famous *Bullion* mine, which is situated a few miles from Quesnel Forks. This mine was a big producer under the management of the late John Hobson, but since about 1912 has been tied up in litigation. At one time the property was magnificently equipped with water systems and everything necessary for large-scale hydraulic operations. As might have been expected, the ditch-lines, flumes, etc., have deteriorated very considerably and some time and considerable capital will be required to re-equip the property. Reconstruction-work was started this summer and it is hoped to have the property in shape for operation during the season of 1922.

The completion of the hydraulic plant on the *Kitchener* mine on Keithley creek was accomplished during the early part of the summer and piping was carried on steadily until the freeze-up in the winter. During this season and probably part of next one drifted ground was piped, but still fair "pay" is being recovered. It is expected that when the pit advances to virgin ground some rich "pay" will be obtained.

All the usually operated hydraulic mines were worked during the season and a considerable amount of small-scale work by individuals was carried on. Testing of certain areas for dredging or hydraulic installations were carried out in certain places and in some of these the results were highly satisfactory.

The production of placer gold for the year is estimated at $67,400, which compares with $66,000 in the preceding year.

The season was a fairly satisfactory one for the hydraulic miners, for although there was a considerable dry spell in the middle of the season, when there was no water for piping, this was compensated by an extra long run in the fall, due to excessive rain and mild weather. It was, in fact, an exceptionally long hydraulic season, but operators did not secure the best results from the water owing to their fear that the rains were not going to last, and consequently preparations were not made for it.

Late in the fall considerable excitement was created by the report of a new rich strike on Cedar creek, a small stream which flows into Quesnel lake a few miles above Quesnel dam. This discovery was not examined by the writer, but under the heading of "Cedar Creek" will be found a short report by the Gold Commissioner, in which some details of the new strike are given.

Although a good deal of the Cariboo District has been fairly closely prospected for placer-ground, there is still a possibility of some rich creeks still existing which have not been discovered; and without doubt there is much virgin ground yet to be worked on the old well-known, formerly-worked placer creeks. Besides these possibilities there are large areas of low-grade ground throughout the district which will in time be worked.

Barkerville Section.

Hopp Mines. Of the placer properties controlled and operated by John Hopp in the vicinity of Barkerville, two were operated during the season; these were *Lowhee* and *Mosquito Creek*. The operations at Lowhee were more satisfactory than in recent years and a good season's clean-up was reported. At Mosquito creek the water-supply is always limited, but the long season of water helped considerably this year. Practically no work was done at Stouts gulch this year, this property being apparently about worked out. The Hopp properties were managed during the year by L. Muller.

Waverly. Piping was carried on practically continuously at this property from May until November. This is an old hydraulic mine on Grouse creek, which was reopened last year and is being worked under the supervision of C. W. Moore. The work so far done has consisted of dead-work in opening up a long bed-rock drive to attack the channel at a point considerably below the old workings. It is not believed that much return was received from the piping operations this year, but at the end of the season it was believed that the pay-channel was being reached.

Point.—This property, which is situated on Slough creek and is owned by a Chinese syndicate, was operated as usual and a satisfactory clean-up is reported.

Perkins Gulch.—This property is situated a short distance from the town of Stanley and is owned by Felker, Sparks & Fraser. They report a successful season's operations.

Other Placer Properties.—Small-scale work was carried out by J. McDougall on Devil's Canyon creek, E. L. Houser on Antler Creek, A. F. Brown on Cunningham creek, Leopold Muller on Dragon creek, Moore & Stevens on Walker's gulch, and other individuals in different parts of the section.

Proserpine Mountain.

Prospecting, assessment-work, and development of a number of the quartz properties on Proserpine mountain was carried out during the year by various owners. Seymour Baker and Saunders did considerable work on their properties.

The properties owned by Armstrong, Tregillus, and partners have not had much work done on them since the Bryce Syndicate relinquished its bond in the spring of 1920. It is believed that these properties, which have been described in detail in previous Annual Reports, would warrant further exploration, as the results attained by the Bryce syndicate were not sufficiently conclusive to definitely settle the matter. Apparently this syndicate considered that the whole veins, quartz lenses and associated schist, would have to stand up to low-grade milling

Finger Lake, Cariboo M.D.

Cedar Creek, Quesnel M.D.—Placer Claim on.

ore, or the property was not promising enough to go ahead with. It would seem, however, that portions of the veins might pay to work and other portions are practically barren of gold values. With the favourable conditions now existing for gold-mining, an examination and thorough sampling of these properties is strongly recommended to any one looking for gold properties.

Cottonwood River.

The testing of a group of leases on the Cottonwood river which are owned by a California syndicate was commenced this year. Some pits were sunk and a drill was operated a short time. It is believed that one hole was put down with the drill, but that bed-rock was not reached. When the writer was in the district in August the work had been stopped and the representatives of the company had left. It is claimed, however, that they are satisfied with the testing carried out and that a dredge of some type will be erected to mine the ground.

Farther up the Cottonwood river, some 16 miles from the mouth and about 15 miles from Quesnel, N. G. Larsson has been engaged for the last three years in prospecting a number of placer leases. Good values are found in the surface gravels at a number of places on the property. The leases cover considerable deposits of gravel stretching for about a mile up-stream from the commencement of a rocky canyon on the river. The gravels are apparently of Post-Glacial origin and represent old bars of the river which have been more or less concentrated by the damming action of the bed-rock spur, through which the river has been forced to cut a canyon.

The work done by Larsson consists of surface pits, but owing to water it has been impossible to go down more than 6 or 8 feet in the gravel. The depth to bed-rock is unknown, but in many places it will probably be 30 feet or more. The surface prospects are sufficiently encouraging to warrant the further exploration of the ground by drilling or some other method. It is probable that the only method of working the ground would be by some form of dredging.

Peters Creek. In the fall of the year a syndicate made up of several members of the staff of the Northern Construction Company at Quesnel obtained an option on the old Mathers property on Peters creek. This property was a producer some years ago and it is believed there is much workable pay-ground in the property yet. This is a drifting proposition, the ground being reached by a shaft. Hoisting was done by a water-wheel driven by the water from the creek. The old machinery, flumes, etc., were found to be in fairly good repair and by the end of the year the plant was put in shape for operation and actual mining commenced.

The property will be worked all winter with a force of from six to eight men. About the end of January (1922) it was reported that good pay-ground had been struck and that operations were proceeding very satisfactorily.

La Fontaine. This mine is situated on Lightning creek, about 1½ miles below the town of Stanley. The property was extensively worked some years ago by means of a bed-rock shaft in the rim and bed-rock drifting below the present bed of Lightning creek. The drifts were broken through to the bed-rock gravels wherever desirable and the whole stream-bed for some distance up and down the creek thoroughly tested. At that time the property was well equipped with hoisting machinery, pumps, etc., all driven by steam.

It was finally decided that the proposition was fully tested and that the bed-rock gravels were not rich enough to work, and work was stopped. Subsequently the property was acquired by L. A. Bonner, who moved the machinery to another property he was working.

After studying the whole evidence carefully Mr. Bonner reached the conclusion that the rich lead of Lightning creek which was worked for about 3 miles (above and below the town of Stanley) would not be found in the present channel of Lightning creek at the *La Fontaine* workings. That is to say, the Tertiary channel of Lightning creek is not followed by the present channel of Lightning creek where it goes through *La Fontaine* ground. Mr. Bonner believes, and adduces considerable evidence to support his theory, that the old Tertiary channel and accompanying rich "lead" lies in the right bank of the present stream-channel. Some Keystone-drilling done by Mr. Bonner a few years ago across the supposed line of the old channel apparently shows that there is a channel at this point.

Mr. Bonner considers that if an old channel can be proven at this point it is a reasonable speculation to explore this channel by deep-drifting methods to find a possible continuation of the rich "lead" of Lightning creek. It should be mentioned here that the rich "pay" of

Lightning creek in the vicinity of Stanley was contained in a well-defined "lead," of apparent Tertiary age, consisting of highly auriferous gravel.

In order to get financial assistance in his project, Mr. Bonner finds it necessary to first of all demonstrate that there is such a channel lying under the hill and to the right of the present stream-bed of Lightning creek. Mr. Bonner therefore asked the Government to do some further Keystone-drilling to prove the correctness or otherwise of his theory regarding an old channel, but agreed to put up the entire expense of this work. In this way Mr. Bonner will secure an official report regarding his project and any possible criticism of the drilling being affected by being done by the owner will be eliminated.

Under this plan the drilling was started about the end of December. C. W. Moore, an experienced hydraulic miner and Keystone-drill operator, was placed in charge of the work at the drill. It is expected that two or three months will suffice to do the required drilling to settle whether or not there is an old channel at this point. In the event of such a channel being proven, Mr. Bonner has practically arranged for the necessary capital from England to carry out the exploration of the channel.

QUESNEL MINING DIVISION.

Quesnel River Section.

Further work was carried out this summer by the Cariboo Gold-Platinum Extracting Company on its property on the Quesnel river, situated 15 miles above the town of Quesnel. A scraper-dredge type of plant erected on the property in 1920 was operated during this summer. The work this year was more in the nature of experimental test runs to determine the efficacy of the plant to save the fine gold- and platinum-bearing black sands that occur in the gravels. Just what results were attained by the company this year are not known. S. J. Marsh is in charge of the work.

Bullion.

It has been mentioned in the general remarks that the *Bullion* mine was reopened this year. An excellent report on this property by W. Fleet Robertson can be found in the Annual Report of the Minister of Mines for the year 1902. It will be interesting to review very briefly the history of this property. Under the guidance of the late John B. Hobson, the mine was thoroughly equipped and made the most important hydraulic-mining enterprise in British Columbia. Thirty-three miles of well-constructed ditches and accompanying dams, reservoirs, and flumes comprised the water system, which was capable of delivering at the mine 5,000 miners' inches of water under a head of 420 feet. The property was worked until 1906 with Mr. Hobson in charge, when the control was taken over by the Guggenheim Exploration Company. In 1907 this company stopped operation of the mine and never resumed. In 1912, on the assumption that the property had been abandoned and therefore reverted to the Crown, it was staked by John Hopp. At about the same time the Guggenheim interests sold the property to R. T. Ward. A famous lawsuit thereupon ensued, which finally resulted in the Privy Council giving the decision in favour of Ward in 1919. In his purchase of the property and subsequent litigation Ward was backed by various interests. Later some friction and resulting lawsuits occurred between the various backers of Ward. Just how the ownership stands at present is not known to the writer, but a syndicate which apparently has possession is now actively engaged in putting the property in shape for operation.

The bed-rock tunnel which Hobson commenced in order to give better dumping facilities for the hydraulic pit is being driven ahead, and a shaft at the head of the pit is being sunk to meet this tunnel. A great deal of work will be required to put the old ditch-lines, flumes, pipe-lines, etc., into good condition again, and this work has also been started. Considerable capital is required to re-equip the property, as much deterioration has taken place during the long period of idleness. It is hoped to have the water system sufficiently repaired so that some piping can be carried on next season.

It is believed that there is still a considerable yardage of pay-gravels ahead of the old pit which can be mined at a profit.

Group. Copper Queen

This group consists of the *Copper Queen*, *Diamond*, and *Blackbird* claims and is owned by George Adams, D. D. Fraser, and Fred Gingras. The property is situated on the Quesnel river about 30 miles from the town of Quesnel; the claims being at a distance of 2 or 3 miles from the Quesnel river on the

north-easterly bank. The property can be reached by trail from Quesnel on the north side of the river, or by the Dragon Lake road to the 25-Mile ferry on the Quesnel river, and thence by trail. The last few miles to the property there is practically no trail, but it is fairly open country and a horse can be ridden almost anywhere. The nearest point to the property for accommodation is Bastion's ranch, which is about 5 miles distant down the river. The showings are on the top of a small knoll slightly higher than the surrounding country, at an elevation of 3,700 feet.

The rock formation exposed on the property is a dark green-coloured igneous rock somewhat metamorphosed which might be classified as an augite porphyrite. In this formation there is a band of schist which would seem to represent a line of shearing in the porphyrite which has caused a zone of pronounced schistosity. In this schistose zone there is a fairly well-defined quartz-filled fissure which forms the showing on the property. The schistose band is from 10 to 20 feet wide, while the quartz vein is from 1 to 2½ feet in width. In one of the showings the quartz vein is split up into a number of inch-stringers spaced through the schist.

The principal development-work on the property is a large incline shaft 20 feet deep. The vein strikes north and south (mag.) and dips at 30° to the east. The valuable minerals contained in the quartz gangue are tetrahedrite and at the surface azurite, which has resulted from the oxidation of the sulphide. A little chalcopyrite was noted in one place. As disclosed by the incline, the vein is clearly defined and varies from 1 to 2 feet in width. The following table shows the values obtained from sampling:—

Description.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Across 2 feet of vein at foot of incline (full width of vein)	Trace.	Trace.	2.1
Across 26 inches of vein at point 10 feet above bottom of incline	0.02	16.4	4.2
Average grab sample of dump	Trace.	10.6	3.2
Selected high-grade ore; represents hand-sorted ore	0.08	44.2	12.2
Quartz from stringers on lower showing	Trace.	Trace.	*Nil.*

Samples of the schist enclosing the quartz vein showed no appreciable values. This vein crops at different points on the hill for a few hundred feet, but the best showing is at the point where the incline shaft was started.

Keithley Section.

The name "Keithley section" embraces the country lying on and around Keithley, Snowshoe, Little Snowshoe, and other creeks and Cariboo lake. Placer-mining was commenced in this section many years ago, the earliest workings being prior to those of the Barkerville section. Mining has been carried on more or less continuously ever since, but in recent years the production has been quite small. The most important workings were on Keithley creek, from which a considerable production has been recorded. Much gold was taken out of the present creek-bed of Keithley creek by cleaning up the stream-gravels to bed-rock. In addition, a high channel on the bench on the north-east side of the stream has been worked and in places yielded very rich "pay." This channel is undoubtedly an old pre-glacial channel capped over and filled in by glacial and stream gravels and talus material. It lies about 100 feet above the present creek-bed and is only a short distance away from it. This channel has been worked in a number of places, but the channel would seem to be somewhat disconnected and irregular.

Kitchener. This property is situated on Keithley creek, about a mile above the mouth. The owners were Harrison & Worth, who worked the property as a drift-digging for five or six years. In 1920 control of the property was acquired by a syndicate formed by some of the directors of the Quesnel Hydraulic Gold Mining Company. This company has been operating a large hydraulic mine at Hydraulic, on the Quesnel river, with K. C. Laylander in charge as superintendent. On acquiring the property in 1920 a small ditch-line was put on from 4-Mile creek, but little or no piping was accomplished. This year (1921) the company's plant at Hydraulic was not in operation, so Mr. Laylander took active charge of the *Kitchener* mine and equipped the property with a good hydraulic plant.

Water from Keithley creek was laid on by means of a 4½-mile ditch, which included some fluming and a siphon. The ditch from 4-Mile creek connects with the large ditch, so that an ample water-supply is assured. The water from 4-Mile creek is expected to start earlier in the spring than the Keithley water, thus giving an earlier start at piping. The plant will deliver 2,000 miners' inches of water at a head of 309 feet, but in actual operation only about 1,500 inches is being used.

The ground that is being worked on the *Kitchener* mine is part of the old pre-glacial bench channel of Keithley creek. It is ideally situated for hydraulicking, as there is a 100-foot dump into the creek from the end of the flume. The depth of ground to be worked off is from 50 to 100 feet. The rich pay-gravel is on and near bed-rock and consists of pre-glacial gold-bearing gravels. Capping this are glacial gravels and clays which may contain a little fine gold. In the drift-workings of Harrison & Worth ground running from 2 to 5 oz. to the set (8- to 10-foot caps) was taken out.

The property has been well equipped with camp buildings, shops, etc., and everything required for efficient operation. A small air-compressor supplies power for air-drills used in drilling boulders, which are then broken up by blasting. The camp is electrically lighted and powerful search-lights placed in the hydraulic pit allow of continuous operation of piping during the twenty-four hours. Keithley creek under normal conditions carries a large stream of water and, except in rare instances of a prolonged dry spell, will provide ample for water for hydraulic operations. The hydraulic season at this property should last for six or sexen months each year. Only a short flume is required to carry off the tailings, so that the expense of flume, blocks, etc., is at about a minimum. Somewhere about $90,000 has been expended in equipping the property.

The ground piped off this season was ground that had been drifted by Harrison & Worth, and large returns were not to be expected, but the pit should be advanced into virgin ground next season, when good returns are confidently expected.

Horsefly Section (Harpers Camp).

The writer did not visit Horsefly (Harpers Camp has been officially renamed as Horsefly) this year, but has heard that a certain amount of prospecting of the ground in the vicinity of Ward's Horsefly has been carried on by R. Campbell and partners. Some of this work was on the bench across the river, where the Keystone-drilling was done last year by the British Columbia Government. It is reported that fair values have been obtained, much better, in fact, than was indicated by the drilling of the ground. Values of from 25 cents to $1 a yard, as reported by Campbell, would make this good ground if it could be worked by hydraulicking or dredging. These values are reported as being found in prospect-pits that were sunk, and as such the results should be considered as decidedly encouraging. Just why the Keystone-drill results should be so much lower is not apparent, but the matter is considered of sufficient importance to the public to warrant giving all possible information bearing on the value of the ground.

Cedar Creek.

There has been some excitement created this past fall over reported finds of gold on Cedar creek. The writer has been unable to investigate these personally, but the following information is given as it was obtained from men who have been working and prospecting on the ground.

Cedar creek is a small stream which flows into Quesnel lake on the north side, about 3 miles up the lake from the old dam at its outlet, and heads near Spanish lake, but over a divide therefrom.

There is a stage-road from the main Cariboo road at 158-Mile House into Quesnel Forks, and to the old Hobson pit at Bullion, on the Quesnel river, and to the dam on Quesnel lake, while there was an old road from Quesnel Forks, on the north-east side of the river, to the mouth of Cedar creek.

From this, it will be seen, transportation to the camp is easy and reasonably cheap, as placer camps go, which should make operating and living expenses reasonable.

It is possibly too soon to predict whether the discoveries or rediscoveries in the camp will prove important channels, or whether they are only remnants of old channels.

As to the probabilities of the section: The general course of Quesnel lake is east and west, while the 5 miles of the lake from the outlet takes a sudden bend to the north-west in direct

line with the Quesnel river to the Forks, which has been gold-bearing. The old gold-bearing channel at Bullion undoubtedly followed the general trend of this part of the Quesnel river, and the Bullion pit is about midway between Cedar creek and the Forks. There is therefore a distinct possibility of there being an important old channel, following the usual south-east trend of placer-drift, possibly extending at least as far as Cedar creek.

The old dam has recently been partially blown up with dynamite and has so lowered the level of Quesnel lake, exposing a bar at the mouth of Cedar creek.

According to the statements of a syndicate which has been working at this point, they found an old channel near lake-level which was bounded on the north-east by a hard rim-rock, through which Cedar creek had broken. From this channel the syndicate brought out some very coarse gold, somewhat similar to the old Bullion product, and this channel is about on a level to coincide with the Bullion channel.

Assuming this information to be correct, it would appear possible that the supposed channel found near lake-level was of a different origin from the gold found higher up Cedar creek, and described in a report received from Mr. Dodd, the Gold Commissioner, which is given herewith. If Mr. Dodd's information is correct, it would seem that the Lyne-Platt findings have not as yet been proved as a continuing channel; but if their figures as to the product of the 50-foot cut are even nearly correct, it would show over $40 a cubic yard in this cut.

These remarks are intended to give an idea of the possibilities of the section rather than as actualities proven by the work so far done.

Following is a report by L. A. Dodd, Gold Commissioner at Barkerville, on the gold strike which was made late in the season at Cedar creek:—

"In accordance with your instructions, I left here on the morning of the November 2nd, via Quesnel for Quesnel dam, as Cedar creek runs into Quesnel lake about 3 miles above the dam. The 'discovery' is about 1½ miles up the creek on its left bank and perhaps some 700 or 800 feet higher than the lake. I found Lyne & Platt, the discoverers, on the ground, in addition to some half a dozen others. Two comfortable cabins have been erected. Mr. Lyne showed me all over their locations, including the pits where they have been working. No work was being carried on during the time of my visit, Mr. Platt being ill.

"These pits, two in number, are about 50 feet long, 4 to 5 feet wide, and less than 3 feet in depth, and from them some 60 oz. of gold had been taken out. Shortly above the second pit (from the creek) the ground takes a sharp rise, and so far no trace of the run of gold has been found in it, though a great number of holes have been sunk in all the draws in the neighbourhood. An effort to drain some of this deeper ground made by the locators on the back locations is being carried on. In digging the drain some fine gold was found until the ground commenced to get over 6 feet deep, after which no traces of gold have been discovered. This drain starts in the Lyne & Platt ground.

"All the ground is very heavily covered by second-growth timber and one could only get around by following paths cut by the prospectors and along the location-lines. I followed these location-lines back a distance of over 6,600 feet from the creek, much farther than where any work had been done, and it would appear to me that the overburden, with the exception of a short portion of the Lyne & Platt locations, runs all the way from 25 to 75 feet deep, which means that the ground cannot be worked advantageously except by hydraulicking. Lyne & Platt have been using the seepage-water for rockers. This is sufficient for this purpose for a short portion of the season only, there being practically no water when the weather is dry.

"Lyne & Platt informed me that they had been looking for the discovery since May last; Mr. Lyne, who is a native of the district, having been informed by an old-timer that gold should exist about where they found it, which is some distance above the old Cedar Creek workings. They do not consider they have made wages during the time they have been engaged in the area.

"The nearest stream of water, I am informed, which might be used for hydraulicking is Rapid river, which would necessitate a ditch-line some 12 to 15 miles in length. It would appear to me that there might also be some possibility that the ground might be dredged, provided the seepage-water could be utilized and is found in sufficient quantities to float a dredger, there being quite a large muskeg off to one side, from which Cedar creek flows.

"From inquiries made to persons conversant with the area as a whole, it appears that discoveries of similar 'spots' have been made for many years in that locality."

PEACE RIVER DIVISION.

The Peace River Division lies to the east of the divide of the Rocky mountains, and most of the area from a geologic and topographic view-point lies in the physiographic subdivision of Canada known as the Great Plains. With the exception of the small part of the Division embracing the watershed and foot-hills of the Rocky mountains, the country consists of a plateau area in which the dominant rock formations are sedimentary measures of Cretaceous age.

So far as yet reported, but few occurrences of minerals in-place are known in the Division. It is possible that in the Rocky mountains important ore-bodies may yet be discovered. The area, however, has important and valuable resources in placer gold and coal, and very probably in petroleum. These will be discussed under their respective heads.

PLACER GOLD.

For many years past it has been known that the sands and gravels of the Peace, Finlay, Ingenika, and other rivers in the Peace River Division are gold-bearing. This gold is, as a rule, fine, and some at least of it may be classified as flour gold. As would be expected, the gold content of the gravels varies greatly, and only at certain places along these rivers is the ground rich enough to be considered to be workable. There are, however, believed to be many areas in which the gold content is probably sufficient to make the gravels desirable dredging-ground. In some places natural concentrations, as on bars, etc., have been worked on a small scale with rockers by individuals, but no large production has been made. During the past few years, however, a number of companies have been testing certain areas with a view to installing dredges for working the ground, and it is expected that some of these projects will before long reach the production stage.

The Tanisto Mining and Development Company, Limited, commenced the testing of a number of placer leases on the Ingenika river in 1920 with a drilling outfit. The results were reported to be satisfactory and further work was carried on in 1921, but the results of this year's work are not known.

The Peace River Gold Dredging Company has a number of leases on the Peace river and testing of this ground has been carried out during the last two years. The results are said to have been satisfactory and the plans for putting a dredge on the property are now being considered.

Several large blocks of leases on the Peace river are held by W. A. Aubin and preparations for testing this ground are under way.

COAL.

Along the Peace river and some of its tributaries there are surface croppings of coal-seams and coal formation which indicate that there is a considerable coalfield in this section. A report on this coalfield was made for this Department in 1912 by C. F. J. Galloway and published in the Annual Report of the Minister of Mines for that year. This report shows that there are cropping out along the Peace river a number of seams of bituminous coal of excellent quality. Analyses of this coal show it to be low in ash and of a composition such as to make it a high-grade steam-coal and also suitable as domestic fuel. The seams described in the above report vary in width from 2 to 4 feet, but larger seams are known to occur in the field.

Practically no development has been done in this coalfield, as up to the present there has been no inducement to do so. Without railway transportation there is, of course, no market for this coal and the development of the field must wait until at least railway-construction is definitely assured. The field is, however, a valuable potential asset and will probably be developed in the near future.

OIL.

During recent years much interest has been aroused over the oil-producing possibilities of the Great Plains, and much exploratory work has been carried out by various companies and individuals and also the Geological Survey of Canada. The Imperial Oil Company has been particularly active in this work and has spent much money in geologic exploration and mapping and well-drilling at various points stretching from the International Boundary-line to Fort Norman, on the Mackenzie river.

While primarily this work commenced in Alberta, it was not long until it was recognized that the Peace River Division of British Columbia presented very considerable promise of success in oil exploration. The Cretaceous and underlying formations are believed to have horizons which may contain oil in commercial quantities, and generally the prospects are as favourable as anywhere in the Great Plains.

The need for geologic information was recognized by the British Columbia Government, and so in 1919 the late Professor J. C. Gwillim was engaged to make a geologic reconnaissance of a portion of the Peace River Division. The report by Professor Gwillim was published in a bulletin entitled "Report of Oil Survey in the Peace River District, 1919." It should be explained here that in British Columbia all coal and oil lands are administered by the Department of Lands and not by the Department of Mines.

In 1920 the oil investigation was continued, certain areas designated by Professor Gwillim being examined in greater detail. This work was done by John A. Dresser and Edmund M. Spieker, and the results are contained in a bulletin entitled "Report of Oil Surveys in the Peace River District, 1920," issued by the British Columbia Department of Lands.

As a result of the reports by Dresser and Spieker it was decided to test certain promising points by diamond-drilling. Such drilling was expected to give important information relative to the formations at these points, depth to certain horizons, and some criteria regarding the presence or otherwise of oil and gas. This drilling was done during the summer of 1921, but as yet no results have been given out.

Late in the year a well being drilled at Rolla, B.C., by the Imperial Oil Company penetrated a formation carrying natural gas and a heavy flow of gas under considerable pressure is now coming from the well. The officials of the company consider this a highly favourable indication and are confident of finding oil in quantity in the lower horizons.

Most of the exploratory work for oil in the Peace River Division has been done in that portion known as the Dominion Peace River Block. In this block the surface land rights are controlled by the Dominion Government, but all mineral rights, including coal, oil, and natural gas, are controlled by the British Columbia Government.

There is a large area in the Peace River Division and in the Liard Division, lying to the north, in which the possibilities of finding oil are favourable and undoubtedly much exploratory work will be carried out in the near future.

CARIBOO DISTRICT.

CARIBOO MINING DISTRICT.

REPORT BY L. A. DODD, GOLD COMMISSIONER.

I have the honour to submit herewith the office statistics for the year ended December 31st, 1921.

OFFICE STATISTICS—CARIBOO MINING DIVISION.

Free miners' certificates issued	211
Mineral claims recorded	93
Certificates of work ("Mineral Act")	62
Placer claims recorded and rerecorded	46
Leaves of absence	11
Powers of attorney recorded	141
Applications for placer-mining leases	177
Placer-mining leases issued	117
Certificates of work ("Placer-mining Act")	100
Conveyances and agreements recorded	125
Leases in force	326

Revenue.

Free miners' certificates	$ 1,550 00
Mining receipts, general	17,223 19
Other sources	1,363 85
Total	$20,137 04

OMINECA AND PEACE RIVER MINING DIVISIONS.

REPORT BY STEPHEN H. HOSKINS, GOLD COMMISSIONER.

I have the honour to forward herewith the office statistics for the Omineca and Peace River Mining Divisions for the year ending December 31st, 1921.

OFFICE STATISTICS—OMINECA AND PEACE RIVER MINING DIVISIONS.

Free miners' certificates (ordinary)	602
Free miners' certificates (company)	7
Free miners' certificates (special)	5
Mineral claims recorded	228
Certificates of work issued	628
Placer claims recorded	5
Bills of sale, mining agreements, etc.	150
Powers of attorney recorded	43
Mining documents filed	44
Certificates of improvements recorded and issued	15
Crown grants of mineral claims issued	15
Applications for placer-mining leases (Omineca Division)	5
Applications for placer-mining leases (Peace River Division)	42
Placer-mining leases issued (Omineca Division)	5
Placer-mining leases issued (Peace River Division)	27

Revenue.

Free miners' certificates	$10,875 55
Mining receipts	3,853 00
Total	$14,728 55

QUESNEL MINING DIVISION.

Report by R. M. McGusty, Mining Recorder.

I have the honour to submit herewith my report on mining operations in the Quesnel Mining Division of the Cariboo District for the year ending December 31st, 1921.

As in the past, the Resident Mining Engineer is forwarding a report on the various properties throughout this Mining Division.

The improvement in the general outlook for mining in this Division has been more than maintained during the year under review; the placer strike on Cedar creek being to a certain extent responsible for this. Interest, however, in other sections of the district has also been displayed, noticeably in the Keithley and Horsefly placer-gold areas.

The number of applications for mining leases shows a steady increase, being far in excess of any previous year.

Office Statistics—Quesnel Mining Division.

Free miners' certificates issued	179
Mineral claims recorded	17
Certificates of work issued	4
Placer-mining records	10
Placer-mining rerecords	10
Powers of attorney recorded	48
Bills of sale and mining documents	3
Mining-lease applications	91

EASTERN DISTRICT (No. 5).

REPORT BY A. G. LANGLEY, RESIDENT ENGINEER.

(Reports marked * are by B. T. O'Grady, Assistant.)

INTRODUCTORY REMARKS.

The sudden depression in metal prices had a serious effect on many of the principal silver-lead producers, especially in the Slocan, where they had hardly recovered from the "tie-up" caused by the O.B.U. strike of last year.

Many properties throughout the district were forced to temporarily suspend operations, while others were either leased to small operators or continued development on a reduced scale pending more favourable market conditions.

The low price and lack of market for lead and zinc eliminated to a large extent the mining of low-grade ores.

The price of silver, which during the first six months of the year hovered around 59 cents an ounce, began to show strength in July and gradually increased up to 71 cents in October.

In September the Consolidated Mining and Smelting Company of Canada, Limited, called a meeting of the mine-owners at Nelson, at which general conditions appertaining to mining and smelting rates were the chief matters discussed. As a result of this meeting the company decided to make the terms of payment for ores received more acceptable to the mine-owners, and at the same time remodelled their Schedule C. This action of the company, together with the more healthy tone of the silver market, tended to stimulate mining and create a more optimistic sentiment among the silver-lead operators than existed earlier in the year.

Mining activities of leasers, prospectors, and small operators seem to have been on the increase during the last few years and no marked falling-off was noticeable this year; in fact, there has been an increase in gold-prospecting.

The outstanding and surprising feature of the year, in view of the adverse market conditions, is the record production of lead and zinc by the Consolidated Mining and Smelting Company's smelter and refinery at Trail, where over 400,000 tons of ore has been treated during the year. The bulk of this immense tonnage was produced by the *Sullivan* mine. This achievement was made possible by the ability of the company to finance the carrying of large accumulated metal stocks and to improvements in the metallurgical treatment of the complex *Sullivan* ores.

The resultant benefits to the district of maintaining this production have been manifold. Some 2,000 men have had steady employment at the smelter and company's mines, the independent shippers have been afforded smelting facilities, and the numerous dependent communities have been sustained. This is a very pleasant contrast to the conditions prevailing at some of the large mining centres in the United States.

The sensational strike of high-grade gold ore at the *I.X.L.* at Rossland is reminiscent of the early days of the camp, and will no doubt attract attention to other properties which have been lying dormant for a number of years.

The successful application of the flotation process by L. H. Biggar at the *Ottawa* mine to low-grade silver ores suggests greater possibilities for many of the "dry-ore" properties.

Men have been plentiful in the various camps and wages have decreased. In the Slocan miners are getting $4.50 and muckers $4 a day. The production of coal from the Crowsnest collieries shows a slight decrease as compared to that of last year. The cause is attributed principally to lack of demand, the mines having only averaged about 75 per cent. of their working-time.

During the early part of the year a series of lectures on geology, ore-deposits, and mineralogy were given at various mining centres. In this work the writer was afforded the hearty co-operation of the prospectors' associations.

In conclusion, the writer wishes to acknowledge the assistance and courteous treatment received from the mine-owners, prospectors, and members of the Geological Survey.

EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

The principal producer of this Division—namely, the *Monarch* mine at Field—was not operated this year owing to the unfavourable conditions governing the market for lead ores.

Among prospecting activities it is interesting to note that the gold-quartz properties situated at the head of the Middle fork of the Spillimacheen river, and which have been lying idle for a number of years, again received attention. W. Orville Young had a few men working during the season on the *Boston* and *International* groups.

Some very fine specimens of talc were brought in from Vermilion creek, and it was reported that the claims were bonded to a company which intended to work them, but no authentic information is available at the time of writing.

Wolverine.

This property is owned by P. Bergenham, of Golden, and is situated near the headwaters of Moose creek at a distance of about 24 miles from Leanchoil Station on the Canadian Pacific Railway. For the first 11 miles the trail follows the old wagon-road built along the north side of Beaverfoot valley. This road was constructed many years ago to serve the *Shining Beauty* mine on Ice river. The country traversed by the trail up to Moose creek is timbered with a scrubby growth of jack-pine and balsam, which makes the trip somewhat monotonous, as little of the surrounding country can be seen.

The scenery at the head of Moose creek is typical of the Rocky Mountains. Some of the peaks, exhibiting great thicknesses of thinly bedded sedimentary rocks lying almost horizontally, seem to have been thrust upwards *en bloc*, leaving precipitous bluffs thousands of feet high, while the intervening talus-covered slopes pitch at a steep angle towards the valleys.

The area is composed of rocks belonging to the Upper and Lower Cambrian age, consisting principally of limestones. No igneous rocks were noticed.

Copper occurs as chalcopyrite in a vein which strikes in a direction of S. 55° E. across a steep hillside towards the summit of the ridge. Values found near the surface and the persistency of the vein encouraged prospecting, in hopes of finding ore in quantity. So far very little work has been done, but from what could be seen the vein is apparently a fissure cutting the formation and formed along a line of shearing.

At an elevation of 7,400 feet, or 2,200 feet above the valley-floor, several shallow open-cuts have been dug in the steep talus-covered slope of the mountain. The width of the vein-matter exposed is 6 feet, lying between limestone and a brecciated mixture of quartz and calcite on the hanging-wall side. The dip of the vein is almost vertical. The ore, consisting of chalcopyrite in a lime and quartz gangue, forms a band of about 1 foot in width. A sample of the best grade ore at the lower cut ran: Gold, trace; silver, 0.3 oz.; copper, 3.87 per cent.

A number of other prospects in this section of the Rocky mountains are described by John A. Allan in Memoir No. 55 of the Geological Survey. In this memoir will also be seen a description of the sodalite-deposits on Ice river at a short distance from the end of the old wagon-road. Its beautiful blue colour makes its an attractive stone for interior decorations.

The Yoho Mining Company, of Claresholm, Alberta, employed a few men during the summer on its property at Ottertail river. The claims, which include the *Sunday*, *Monday Fraction*, *Yvonne*, and *Empire*, are situated at about half a mile up the river from the railway and are easily accessible by wagon-road from Field. Little bunches and veinlets of ore have been found to occur irregularly in the soft stratified clays and shales which form high banks on either side of the river at this point. This formation would appear to be of recent origin, probably belonging to the glacial period.

The old workings, consisting of a 75-foot tunnel in the upper part of the bank and a 70-foot shaft sunk near the river-level, are both caved in. The dump of the tunnel indicates that it must have been driven in surface wash for almost its entire distance.

A few tons of ore is said to have been extracted from the bottom of the shaft and shipped to the smelter. A little ore, which had been left near the top of the shaft, consisted of galena and zinc-blende in a calcite gangue, a sample of which assayed: Gold, 0.01 oz.; silver, 5.2 oz.; lead, 25.7 per cent.; zinc, 17.8 per cent.

The latest work consists of a tunnel run in the direction of N. 15° W. for about 125 feet in a clay-like formation. At a distance of about 75 feet in there is an inclusion of white fluorspar, with which is associated a little galena and zinc-blende.

The formation is not the kind in which such minerals as above described are expected to be found, and the mere fact of finding ore at all is what impressed the writer more than anything else. The only conclusion that can be arrived at is that it is not in-place. Spending money on further prospecting would appear to be highly speculative.

Maud S.* This claim, owned by T. H. Bingham, of Parson, is situated on the northern side of Crystal creek, near the summit of the precipitous divide separating that creek from Vermont creek, about 26 miles by trail from Carbonate Landing on the Columbia river. The formation consists of schists, slates, and conglomerates dipping flatly into the mountain.

Briefly, there is a strong surface showing of galena (disseminated through quartz) in the face of a bluff at an altitude of about 8,300 feet. The bluff rises almost perpendicularly for several hundred feet above a small glacial basin, making the exploitation of the outcrop exceedingly difficult and even an examination a hazardous undertaking.

The ore-showing is apparently connected with a quartz-filled fissure-vein, which, at the bottom of the bluff, can be seen cutting nearly vertically across the sedimentaries towards the north-west. A grab sample of broken ore gave: Silver, 17 oz.; lead, 30 per cent.; zinc, 0.5 per cent.

WINDERMERE MINING DIVISION.

Paradise. A small crew of men has been employed during the season. Shipments were confined to only the highest grade of ore owing to the low metal prices. The tonnage produced will approximate 500 tons for the year. During the summer months the ore is hauled from the mine to the railway at Invermere by a White truck; the total distance from the mine being about 18 miles, while the difference in elevation between it and the shipping-point is about 5,000 feet.

Mineral King. W. L. Smith employed a small crew of men during the season at development and sacking ore from the surface diggings. A good cabin has been built, affording accommodation for eight or ten men. Since the property was examined last year a long open-cut driven in an easterly and westerly direction across the mineralized zone exposes nice showings of ore at intervals across a width of 86 feet. The old tunnel driven into the hillside at a depth of 34 feet below the bottom of this open-cut does not thoroughly explore the mineralized zone, and more drifting and crosscutting should be done.

A 34-foot drift driven last year in a westerly direction from the main tunnel developed ore for nearly its entire length, which shows in the roof as bunches and disseminations of galena associated with small percentages of zinc-blende and iron pyrites. The width of this ore could not be determined as the south side of the drift was in the vein.

The ore-body is not well defined, the whole rock-mass being shattered and sheared, in which ore occurs as irregular bunches and filling gash-veins. By following the direction of the shearing and crosscutting at intervals the best results from further development might be expected. A grab sample taken from ten sacks of sorted ore ran: Gold, 0.04 oz.; silver, 12.3 oz.; lead, 26.1 per cent.; zinc, 6.8 per cent. A sample of broken ore from the face of the West drift gave: Silver, 3.6 oz.; lead, 5.6 per cent.; zinc, 2.2 per cent.

The dump material, which consists of a mixture of ore and waste, probably contains about 200 tons of mill-feed. A sample taken at random over the surface of the dump, of the best grade of ore that might be expected for mill-feed, ran: Gold, 0.02 oz.; silver, 12.1 oz.; lead, 20.2 per cent.; zinc, 21.7 per cent. A number of other samples taken along this drift give an average value of: Silver, 5.5 oz.; lead, 6 per cent.

The recent work done under the present management has certainly improved the appearance of the property and further systematic development would seem to be fully justified.

For further previous references see Minister of Mines' Report for years 1898, 1915, and 1920.

Bear Group. This property, consisting of five claims, is situated on the same hillside and at a distance of about half a mile from the last-mentioned property. A few shallow surface diggings expose the presence of a small quartz vein mineralized with galena, zinc-blende, and a little grey-copper. The vein follows the summit of a

limestone ridge. Further work in the nature of crosscutting may reveal the presence of more ore at a depth. Prospecting was being done under the direction of W. L. Smith.

A sample of carefully sorted ore ran: Gold, 0.01 oz.; silver, 27.5 oz.; lead, 21.7 per cent.; zinc, 1.1 per cent.

Bunyan. Work was continued at this property during the season under the supervision of E. J. Fader. At the time of examination in June a lower crosscut tunnel had been driven for a length of 285 feet in a schist formation. No ore had been encountered, so it was decided to raise in the hope of encountering the ore exposed in the level 128 feet above. This upper level is now completely caved in and the rock in its vicinity is shattered and broken as a result of a big blast which was exploded last year. Barytes outcrops along the upper part of the bluff and it is possible that further prospecting might open up a considerable tonnage, which could be mined cheaply.

Among other properties on which prospecting-work was done are the *Bald Eagle*, on Slade creek, of which John Burman is the principal owner; the *Isaac*, on No. 3 creek, owned by H. E. Forster and recently bonded to W. D. McMillan; and the *Silver Spray*, on Copper creek, owned by Murdock McLeod.

FORT STEELE MINING DIVISION.

Sullivan. The production of this mine has been maintained this year to meet the requirements of the company's smelter at Trail and shows an increase over that of last year. Development and exploratory work with the diamond-drill has been systematically proceeded with.

The long adit-tunnel driven from Mark creek is now in over 9,000 feet. From this level the vein is developed at a depth of 1,500 feet on the dip, which averages about 20° to the east. The direction of the tunnel is N. 3° E. and parallel to the strike of the vein. It has been driven in the foot-wall and lies about 40 feet below the vein. Where ore has been encountered crosscuts have been run to the vein at intervals of 120 feet and a raise driven half-way between each pair of crosscuts.

In order to facilitate the drawing of ore as the stoping proceeds upwards, a parallel tunnel has been driven for a distance of 700 feet and at 200 feet west of the main tunnel. From this tunnel raises will be driven to tap the ore-body, the first one of which was just breaking through at the time of the writer's visit in October. The workings of this level are connected by a raise 761 feet long with the upper workings.

Owing to the flatness of the dip, conditions have not been found favourable for mining on the shrinkage system, as the ore will not run on the foot-wall; hence some method had to be evolved whereby a large tonnage could be economically handled. It would seem that the problem had now been solved to a very large extent by the employment of drag-scrapers in the stopes, two of which are now installed in the large stope of the southerly ore-body.

A 25-horse-power double-drum hoist is set up at the bottom of the stope and the haulage-cable is passed through a snatch-block secured to a ring or cable strung along the top of the stope. A heavy steel-pronged scraper is dragged up and down the foot-wall, bringing on its downward trip anywhere from 2 to 10 tons.

The southerly ore-body as developed from the adit level is situated at a distance of about 7,000 feet from the portal. The width of the vein and its dip vary; this is due to heavy rolls in the walls; at the northerly end of the stope it shows a width of about 30 feet, representing a width of 80 feet where it is cut obliquely by the sill-floor of the stope. The chambers of the stope can best be described as huge underground quarries, in which a pile of 21,000 tons of broken ore seems to take but little room, while to reach the upper faces a little underground mountain-climbing is necessary.

The southerly margin of the north ore-body has been encountered near the end of the adit-tunnel, and at this point the vein swings to the west, so that the direction of the tunnel had to be changed accordingly to avoid running in ore, which was not desirable. Between the north and south ore-bodies there is an iron-sulphide zone corresponding to that on the upper level. On this lower level it is composed of pyrrhotite.

At the upper workings mining is being principally confined to stoping between the 1,000-foot and 1,100-foot levels. The ore is transported to the railway by aerial tram. These workings at present constitute a separate mine, with camp buildings complete.

The outcroppings of the vein on the hillside above the 1,000-foot level, though strong, are not as big or continuous as might be expected for ore-bodies of such vast dimensions.

The total output of the mine for the first ten months of the year was given as follows: Zinc ore, 236,612 tons; lead ore, 54 tons. Between 200 and 300 men are steadily employed.

Among the recent improvements a new camp-site has been laid out on a flat bench at a short distance from the portal of the low tunnel and a few neat buildings have already sprung into existence. The mine equipment is up to date, excellent accommodation has been provided for the men, and an air of efficiency prevails throughout.

Frequent references have been made to this property in previous Annual Reports, while the geology of the area and ore-deposits are described by S. J. Schofield in Memoir No. 76 of the Geological Survey.

PERRY CREEK.

A trip was made up this creek during the latter part of July; unfortunately, owing to unforeseen circumstances, time only allowed the examination of several properties. The area, however, has not been neglected by mining engineers and geologists, while reports on various properties may be referred to in the Minister of Mines' Reports and in Memoir No. 76 of the Geological Survey.

The creek is approximately 20 miles long and empties into St. Mary river at a point about 8 miles north-west of Cranbrook, from where a wagon-road leads to within 7 miles of its head.

Around the head of the creek the summits are rounded and present a fairly even skyline, while the hill-slopes are well covered with detritus supporting a heavy growth of timber. Erosion by glaciation is pronounced and has no doubt been the chief factor in accounting for the concentration of gravels lower down the creek.

Near the headwaters the valley widens, forming a basin-like depression, which suggests that at one time it was either filled by a glacier or small lake. In the opinion of a pioneer placer-miner who had worked on the creek in the early sixties, at one time a lake did occupy this basin and the creek followed a different channel at the falls; owing to an uplift the waters of the lake were flooded down the valley, carrying with them immense quantities of material which choked the original channel with boulders, piled the gravel in high banks on either side, and forced a new channel, through which the creek now flows. Although delving into the depths of the uncertain past, this theory is interesting and sounds feasible, for there certainly is an old channel entering the creek just below the falls, at which point the Wild Horse Gold Mining Company is now operating. This company, under the management of A. J. Palmquist, has succeeded in conveying water from the old flume to the top of the bank, from where it is piped down for a distance of about 300 feet to the monitor stationed 100 feet above the level of the creek.

The gravel filling the old channel represents a bank of about 400 feet high; for the first 100 feet or so it is darker in colour and shows a stratification different from the upper portion, which latter contains a greater proportion of silt. It would seem probable that the old channel occupied a box canyon similar to the one through which the creek now flows.

At the time of the writer's visit the stream of the monitor was playing on a mass of boulders at the bottom of the bank. The sluice-box is laid on the gravel at the edge of the creek and is connected with a flume from a pool just below the falls, which provides additional water for sluicing. On account of the great height of the bank and the limited amount of room between the working-face and the creek, it is a proposition which will have to be worked very carefully; while getting rid of the tailings presents somewhat of a problem, as the grade of the creek does not exceed 3 per cent.

Previous attempts to win the gold from these gravels are described by the Provincial Mineralogist in the Annual Report of the Minister of Mines for 1903, a copy of which description may be seen in Memoir No. 76 of the Geological Survey.

As regards lode-mining on this creek, activity in prospecting was the natural sequence to placer-mining, and the surrounding country was prospected in an endeavour to discover the source of the gold found in the alluvial deposits.

The year 1896 probably marked the greatest activity in this direction, at which time the country was more easily accessible than it is to-day, as the majority of the prospects have since been abandoned, the old cabins have become dilapidated, and many of the trails overgrown and obliterated.

The characteristic features of the area and remarks on milling operations are embodied in the report of the Provincial Mineralogist, who visited a number of properties in 1898, from which the following are excerpts:—

"A large number of claims were from time to time recorded, many of which were justified by the discoveries made, but as many more on no apparent values. The work done has proved, however, that there are without doubt a number of very strong parallel quartz ledges, some of a great width and traceable for miles, running S. 20° W., or about parallel with the general direction of the creek, and dipping nearly vertical.

"Recognizing the futility of trusting to small samples and that a satisfactory test of the various properties could only be determined by a practical test, J. E. Hardman, mining engineer of Montreal, had a small stamp-mill erected in 1897 at the mouth of Sawmill creek for the purpose of making mill tests of the ore from the various properties he had under bond.

"Test runs were made on ore from several of the claims on the creek, in lots of 5 to 10 tons each. The results obtained were not commercially satisfactory, for, notwithstanding the fact that some gold was saved, in no instance were the values sufficiently high to warrant serious work on the claims. The tests, however, do not seem to have satisfied the claim-owners, as the results obtained did not tally with their private assays. I heard several complaints about the matter, regret being expressed that the running of the mill had been left to inexperienced men and values allowed to escape in the tailings. Of this I know nothing further than was told me by men who might be considered 'interested parties.'"

After describing tests made by panning the tailings, he concludes his report as follows: "As a result of my investigation, I am satisfied that the mill did not save such free gold as may have been in the ores, and that the tests made were not conclusive as to the values of these properties. I am further satisfied that only a portion of the gold is 'free' and that some method of concentration would have to be adopted to save the gold occurring in the iron sulphides."

Since this report was written more work has been done at the *Homestake*, *Running Wolf*, and possibly some other claims in the vicinity, but, as far as the writer knows, the two mentioned are the most highly developed. The former was reported on by J. D. Galloway in the Annual Report of the Minister of Mines for the year 1915, and the latter property is mentioned in Memoir No. 76 of the Geological Survey.

Yellow Metal Group.

This group comprises 11 claims, which cover the rounded summit of the divide between Hellroaring and Perry creeks and also a portion of the Perry Creek slope. W. van Arsdalen, who is interested with Ed. McMahen, has spent a number of seasons in prospecting the area in the endeavour to prove the existence of a large body of low-grade gold ore, having been encouraged by the results obtained by panning material from a number of places on the property, more particularly along the summit of the ridge.

The area is underlain by thinly bedded quartzites of the Creston formation, having a strike of N. 25° E. and a dip of 67° to the north-west. On the summit, at an elevation of about 7,000 feet, these quartzites have been crushed and shattered by glacial action, with the result that the surface is covered to a depth of about 6 feet with detritus. The quartzites, shot with small stringers of quartz, upon crushing, yield colours to the pan, but the best results can be obtained from the dirt along the bed-rock below the detritus; the glacial erosion no doubt having performed the same function of concentration, to a small extent, as that of a creek. A sample of some of this dirt taken on a previous occasion only yielded a trace of gold; but assays of small samples of such material cannot be considered as representative, while panning may also be misleading. This band of quartzites shows a width of about 300 feet and has been prospected by open-cuts and long trenches across its strike and a 20-foot shaft, which is now caved.

At a short distance down the Hellroaring Creek slope a quartz vein has been prospected by a 20-foot open-cut along its strike. It has a width of 20 inches and is well defined by 3 inches of gouge on the hanging-wall and crushed material on the foot-wall. In dip and strike it conforms to the formation. A sample taken across 20 inches of quartz ran: Gold, 0.19 oz.; silver, 0.2 oz.. A sample across a 3-inch streak of gouge ran: Gold. 0.32 oz.; silver, 0.3 oz.

On the Perry Creek slope, at no great distance from the main trail, prospecting consisting of open-cut work has been done on two strong quartz veins having a north-westerly strike; the quartz is well mineralized with iron sulphides, but does not carry any appreciable gold values.

Still farther down prospecting has been done on a well-defined quartz-filled fissure, which has the same strike as the quartzites, but cuts them on the dip. The width of this vein is about 4 feet; it strikes N. 23° E. and dips at 80° to the south-east. The filling consists of crushed quartz stained with iron oxide, and it is a promising-looking vein, but as yet has only yielded small gold values. The work consists principally of a shallow shaft, several open-cuts, and two tunnels, the lowest of which has been driven for 25 feet and gains a depth of 125 feet below the shaft.

Further reference to this property may be seen in the Annual Report of the Minister of Mines for 1915.

Park Group.

This group, comprising the *Hercules*, *Park*, and *Bee Line* claims, is owned by W. A. Chisholm and is situated at a distance of 1 mile from the railway at Marysville. The country is undulating and a motor-car can be taken to within a short distance of the workings. The area is underlain by quartzites which have been intruded by diorite dykes and sills. The vein is a quartz-filled fissure in diorite, having a width of about 5 feet and striking N. 80° W. The ore, consisting of galena associated with a quartz and calcite gangue, is free from zinc and carries low silver values. It occurs irregularly distributed over a length of about 200 feet along the strike of the vein.

The property has been systematically prospected by trenches and open-cuts. The strongest surface exposure examined showed a width of 30 inches, across which a sample was taken; this gave the following results: Gold, 0.02 oz.; silver, 3.2 oz.; lead, 18.2 per cent.

Old workings consisting of a shaft 60 feet deep, from the bottom of which 70 feet of drifting had been done, could not be examined on account of water. A shipment of 17 tons made from these workings about six years ago gave the following returns per ton: Silver, 6.1 oz.; lead, 48 per cent.

Further prospecting on the Sand Creek iron-deposits met with encouraging results.

The Federal Mining and Smelting Company has taken a bond on the *Stemwinder*, which is situated on Mark creek between the *Sullivan* and *North Star* mines. Diamond-drilling has been commenced.

Evans Bros., of Marysville, continued their prospecting and development work on the *Achilles* group. Nice samples of copper ore have been brought in from this property.

One of the finest beds of fossils yet found in this district was discovered near the road from Cranbrook to Fort Steele by Colonel C. H. Pollen. The fossils are mostly of the trilobite family and are classified as belonging to the Upper Lower Cambrian.

Dr. S. J. Schofield, of the Canadian Geological Survey, was camped during the early part of the season near Fort Steele, whence he moved northwards into the Windermere Division.

Victor.

Since reporting on this property in 1917 there has been a large amount of money spent on development and mill-construction. The property is owned by the Victor-Silver Leaf Mining Company, of which R. Abernethy, of Spokane, is the president and his son, Elmer R. Abernethy, is secretary. The capital for these recent expenditures has been principally provided by capitalists of Flint, Michigan, under the terms of a lease and bond. R. Abernethy has been retained as manager under the terms of the agreement.

Briefly, the vein cuts a narrow ridge between Maus and Lost creeks and is exposed in a precipitous rock bluff on the Maus Creek side. In this bluff three drifts have been run. The portal of the No. 1, or uppermost, is located at about 1,000 feet below the summit of the ridge and has been driven along the vein for 387 feet. The No. 2 drift is 125 feet vertically below the No. 1 and has been driven for 427 feet. The No. 3 drift was started in the slide-rock at the base of the bluff at 100 feet vertically below No. 2. This tunnel is now in a considerable distance and will be continued this winter. The workings are not connected, no sinking or raising on the vein having been attempted. No ore of commercial importance had been encountered in the No. 3 tunnel at the time of the writer's visit in July.

The ore is a complex mixture of galena, zinc-blende, and iron pyrites in a quartz gangue, and is irregularly distributed as small lenses, streaks, and disseminations. At few places does it exhibit a workable width. The best grade of ore is exposed at the portal of the No. 1 tunnel, where there is a small bunch of coarse cube galena in an oxidized gangue material. A sample of this ran: Gold, 0.03 oz.; silver, 30.3 oz.; lead, 68.1 per cent.; zinc, 6.4 per cent. Other samples taken in the No. 1 and No. 2 tunnels would indicate the values to average about as follows: Gold, 0.05 oz.; silver, 10.5 oz.; lead, 14 per cent.; zinc, 9 per cent.

Sullivan Mine, Fort Steele M.D.—Portal of Tunnel.

Perry Creek, Wild Horse Gold Mining Co.

The mill-site is on the side-hill at a distance of over 1,000 feet from the portal of the No. 3 tunnel, with which it is connected by a covered track. The mill equipment, which was not complete, consisted of a Blake crusher, one set of rolls, and two Overstrom tables.

The water-power available from a small glacier-fed creek was only sufficient to drive an 8 by 9 Sullivan compressor, so additional power is provided by a 25-horse-power, type Y, Fairbanks-Morse semi-Diesel engine, which was said to be giving excellent satisfaction on a consumption of about 12 gallons of coal-oil per 8 hours.

A mixed car-load of ore and concentrates was shipped in the fall.

Placer-mining.

Besides the activities already described on Perry creek, the Gamble Mining Company had a monitor operating on Wildhorse creek. The extreme dryness of the season necessitated closing down work earlier than was anticipated. It is understood that the results came up to expectations and work will be resumed early next season.

Gypsum.

A deposit of gypsum occurs along the north bank of Bull river at a distance of about 3 miles from the main road to Fort Steele and within a short distance from the falls. The branch road leading up Bull river traverses a flat bench in the vicinity of the deposit. The river cuts this bench to a depth of about 300 feet, leaving a steep bank on the northerly side. Unfortunately, the surface of the bank is covered to a considerable depth with soil and few rock-exposures are visible.

However, shallow diggings at various places have uncovered the mineral, and from all indications there is a large deposit conforming to the dip and strike of the formation.

The writer is indebted to Dr. S. J. Schofield, of the Geological Survey, for following notes on the general geology of the area: "The gypsum occurs interstratified with the Devono-Carboniferous limestone, outcrops of which occur lower down Bull river and crossing Kootenay river to the hills west of Wardner. This mass of Devono-Carboniferous limestone is in the form of a syncline, which strikes approximately parallel to the strike of the Kootenay valley. The gypsum at Bull river occurs in the eastern limb of the syncline."

An analysis of a representative sample gave the following results: Gypsum, 80.5; carbonate of lime, 14.4; insoluble, 3.5; magnesium oxide, 0.6; organic matter, 0.8.

The deposit could be further prospected and developed at small cost, while its nearness to both the Kootenay Central Railway and power-site at the falls make it particularly attractive for commercial enterprise.

Graphite.

A small deposit of graphite was discovered on the westerly bank of Matthew creek at a short distance from the wagon-road. The nature of its occurrence was difficult to determine as the formation was so badly faulted and broken, but so far as could be seen it apparently has been deposited along the contact of a micaceous schist and a porphyry dyke. It is of a massive variety and of good grade, but as yet no deposit of commercial importance has been developed. The shattered and faulted ground suggests that the rock along the creek where the work has been done is not in-place but has slid down in large masses from a point higher up the hillside.

Coal Production.

Robert Strachan, Senior Inspector of Mines, reports as follows:—

"The production of coal for the year is about 10 per cent. less than for 1920, and amounts to 759,755 long tons.

"Coal Creek Colliery shows a decrease of about 4 per cent., Corbin 55 per cent., while Michel shows a slight increase.

Colliery.	1920.	1921.	Increase.	Decrease.
Coal Creek	431,783	413,523	....	18,260
Michel	264,592	278,301	13,709	....
Corbin	151,014	67,931	....	83,083
Totals	847,389	759,755	....	....

"Coke production will show about 59,434 tons, a decrease of 8,358 tons from 1920.

"None of the coke-ovens at Fernie have been in use during the year, while only about 50 per cent. of the Michel ovens were required to fill the demand for coke.

"The cause of the decrease in the production is due mostly to lack of demand for coal, the mines having only averaged about 75 per cent. of their working-time.

"While the mines have only worked about 75 per cent. of the working-days, the output of coal will show about 12 per cent. of a decrease, indicating that while the mines were working a larger production was made than when working full time.

"Labour has been very plentiful throughout the year.

"No new mines have been opened at Coal Creek, but all the mines have been operated, and during the summer a large ventilating-fan, with a capacity of 300,000 cubic feet of air a minute, is being installed at the No. 1 East mine, to replace the present Wilson fan, for which the mine has become too large.

"A circular shaft has been sunk, concreted from the rock up, and the fan-house and engine-room are made of the same material.

"It has not been decided yet whether the fan will be driven by steam or electric power, as the completion of the Alberta and British Columbia Power Company's plant at Bull river will probably mean the changing of most of the collieries from steam to electricity as a motive power.

"At Michel the present mines have been developed to such an extent that in spite of the slack time the production is greater than the previous year, and the greatest handicap at present is lack of housing accommodation for the workmen.

"At both Michel and Coal Creek the Crow's Nest Pass Coal Company has been drilling the measures, and while no detail has yet been issued, this work has proved the existence of remarkably fine coal-seams, both over and under the present measures.

"At present a cross-section of over 2,000 feet has been proved at Coal Creek, and no doubt will prove very valuable in the future development of the mines.

"At Corbin the decrease in production runs very high—namely, 56 per cent.—and is due to the closing-down of the Big Showing or open-cut mine.

"The future developments in Corbin will probably be farther up the creek, where the measures seem more regular and the coal carries a less quantity of surface dirt.

"Following this line, the No. 6 mine has been opened 2 miles above the town of Corbin, where the coal seems more regular, although the seam at the 5,390-foot level averages 400 feet thick.

"The intention is to develop this seam along the panel system and extract the pillars as soon as the panel is completed."

WEST KOOTENAY DISTRICT.

AINSWORTH MINING DIVISION.

In common with other silver-lead-producing districts, the Ainsworth Division has suffered from an unusually quiet season and its production of silver and lead will fall short of last year. This is due to the inactivities of the larger producers brought about by the low metal prices.

AINSWORTH CAMP.

Florence.—Large bodies of ore have been developed at this property, but owing to the comparatively low silver content economic production could not be maintained under the prevailing conditions of the lead market. During the early part of the year a small tonnage of the high-grade ore was shipped by leasers to Trail.

Spokane-Trinket.—A small shipment was made from this property, which has been a steady producer during the last three or four years.

Highland.—This mine, owned by the Consolidated Mining & Smelting Company, was operated under lease for part of the season by L. Oughtred, who was formerly in charge of the property for the owners.

No. 1.—This mine, also owned by the Consolidated Mining & Smelting Company, was operated under lease by T. Hawes and associates.

Skyline.—It is reported that work has been abandoned by J. Sime and associates, who were operating it under lease and bond.

Silver Hoard.—S. McPherson and J. Sherman are operating the property under lease.

Krao.—Small shipments of exceptionally high-grade silver ore were made from the upper workings. W. E. Zwicky, who controls the property, is doing some exploratory work below the 100-foot level.

The Lakeshore Mining Company, in which Spokane capital is interested, was formed during the year and a number of claims were acquired, running from the lake-shore up the hill and covering a strip of ground between the *Florence* and *Highland* properties. Work was started by driving a crosscut tunnel, the ultimate length of which will be about 700 feet. The object of this tunnel is to explore, at a depth of 200 feet, promising-looking surface showings and to tap an old shaft now partly filled with water.

Riondel.

Bluebell.—After shipping about 3,450 tons during the early part of the year, operations were suspended pending more favourable market conditions.

Kirby Group. Situated near Riondel and within a short distance of Kootenay lake. During the year work was first confined to prospecting the surface showings near the old workings, under the supervision of A. J. Curle and R. Guthrie. The general run of the ore is a mixture of galena and zinc-blende associated with iron pyrites in a gangue of quartz and spathic iron. Concentration will be necessary before shipping to the smelter; hence the future of the property depends upon the development of sufficient tonnage to warrant mill-construction.

The vein has a strike of north and south and dips at an angle of 35° to the west, or towards the lake, conforming to the stratification of the enclosing rocks. It has been approached by a 55-foot crosscut tunnel and drifted on for about 100 feet along the footwall side. This drift does not gain any appreciable depth and terminates in a deep open-cut, from which a 30-foot shaft has been sunk. The shaft is said to have encountered 4 to 5 feet of milling-ore, but this could not be examined on account of water. The great depth of wash overlying the bed-rock renders further exploratory work along the strike of the vein both expensive and unsatisfactory.

Evidences of vein-matter in the bed of a small creek immediately above the shaft led to further prospecting slightly higher up the hill, and a nice showing of ore was uncovered by trenching. The work done on this had not been sufficient to prove the true width of the vein or its relation to that exposed by the workings already referred to, but it is probably either a parallel vein or the same as that exposed in the tunnel.

However, the surface showings were considered sufficiently encouraging to justify exploration at a greater depth, and with this object in view a long crosscut tunnel was started from a point near the lake-shore. It is estimated that this tunnel will gain a depth of 300 feet on the dip of the vein. The accumulation of wash which forms the lower benches of the hill is greater than was expected, for the tunnel is now in 285 feet and there is still no sign of bed-rock.

Further reference to this property may be seen in the Annual Report of the Minister of Mines for 1920. In this report the following typographical error was noticed: "dykes of rock" should read "dyke-rocks" on page 120.

Woodbury Creek.

This creek, heading from the Kokanee glacier, flows in an easterly direction and enters Kootenay lake at a point 2½ miles north of Ainsworth. It drains a large granite area lying to the west of that underlain by the sedimentary rocks bordering the lake. It is in this granite area that the following described properties are located. As will be noticed, the ores are of high grade, carrying little zinc and a high ratio of silver to the unit of lead.

Jessie Bluebird.* This property, owned by E. Johnson, of Kaslo, is situated at an elevation of about 6,500 feet (lower tunnel) on the northern side of the North fork of Woodbury creek, about 10½ miles from Kootenay lake. The *Jessie Bluebird* trail, about 1½ miles in length, branches off the main Woodbury Creek trail at a point about

9 miles up from the lake. The workings, which aggregate some 1,500 feet of development, follow a zone of shattered rock or sheared fissure in granite which in places exceeds 20 feet in width.

The ore occurs mostly in siliceous stringers and lenses, ranging from 1 to 2 feet in width, which run in an irregular manner through the fissured and altered granite, but is also found disseminated through or in small bunches in the granite itself. It consists principally of galena, grey-copper, and silver sulphides, and is considerably leached and decomposed from oxidation.

The lead strikes in a south-westerly direction, dipping at about 58° to the north-west, or into the mountain. Access to the lead is by means of two crosscut tunnels about 100 feet vertically apart. The upper crosscut or No. 1 level is 80 feet to the lead, which has been drifted on for 200 feet to the south-west. A sample across 12 inches in the floor of this drift, about 50 feet in from the crosscut, gave: Gold, 0.04 oz.; silver, 209.6 oz.; lead, 8.9 per cent.; zinc, 0.5 per cent.

Two winzes sunk on the lead from this drift are 70 and 110 feet in from the crosscut and 45 and 25 feet down respectively. A short drift has been run to the north-west from the bottom of the 45-foot winze, where a lens of ore was encountered. The lower crosscut or No. 2 level is 200 feet to the lead, which has been drifted on for about 500 feet to the south-west. At a point 395 feet along this drift from the crosscut a raise 120 feet long on the dip of the lead connects with No. 1 level, and 50 feet up this raise an intermediate tunnel has been driven 50 feet north-easterly. An average sample across a lens of ore 12 inches wide and 25 feet long in the floor of this intermediate level gave: Gold, 0.05 oz.; silver, 366.5 oz.; lead, 7.9 per cent.; zinc, 4.4 per cent.

At the time of the writer's visit in September stoping was in progress from three 40-foot raises above the south-western end of the drift on No. 2 level. The stope was then 60 feet long and was being carried about 4 feet wide.

The ore is roughly sorted in the stope and re-sorted in daylight, as only the highest grade is shipped at present owing to the heavy packing charges to Kootenay lake, which amount to $30 a ton. A grab sample of roughly sorted ore in the stope gave: Gold, 0.02 oz.; silver, 217.6 oz.; lead, 24.2 per cent.; zinc, 0.5 per cent. A grab sample from about 6 tons of ore sorted for shipment gave: Gold, 0.05 oz.; silver, 382.4 oz.; lead, 13.5 per cent.; zinc, 1 per cent.

The sorting requires an intimate knowledge of the character of the ore, as some of the best values are obtained from material which looks unattractive to the uninitiated.

The workings are mostly on the foot-wall side of the lead and scarcely any crosscutting has been done. Twenty-one tons of ore was shipped to Trail in October.

Grant.* This property, consisting of the *Grant* and *General* Crown-granted mineral claims, is situated on the north slope of the mountain on the southern side of the North Fork of Woodbury creek, about 5 miles in a direct line from Kootenay lake, the nearest shipping-point being the Princess Creek wharf, distant about 8 miles by trail and road (6 miles by trail and 2 miles by road). The property is owned by C. F. Olson, of Ainsworth, and is being operated under lease by Bridge & Kennedy.

The altitude of the lower tunnel is about 4,500 feet. Grey-copper carrying high silver values, with small amounts of galena and zinc-blende, occur in small shoots in quartz-filled fissure-veins which cut a siliceous limestone formation near its contact with the granite. The principal work has been done on a vein cutting vertically across the formation in a north-easterly and south-westerly direction. Access to the vein is by means of two crosscut tunnels about 80 feet vertically apart. The upper crosscut is 28 feet to the vein, which has been drifted on for about 100 feet to the south-west. An ore-shoot encountered in this drift was stoped to the surface. The lower crosscut is 100 feet to the vein, which has been drifted in for about 400 feet to the south-west. Two raises, about 130 and 250 feet distant respectively from the crosscut, are up about 60 feet.

At the time of the writer's visit in July Bridge & Kennedy were stoping, sorting, and sacking ore from these raises. The width of the vein in these stopes varies from 1 to 2 feet, with a rich pay-streak of quartz and grey-copper from 4 to 8 inches in width. A sample across an 8-inch pay-streak in the stope farthest in from the crosscut gave: Gold, 0.02 oz.; silver, 629.4 oz.; lead, 13.3 per cent.; zinc, 4.8 per cent. A sample across a 4-inch pay-streak in an open-cut above the upper tunnel gave: Gold, 0.08 oz.; silver, 851.1 oz.; lead, 35.8 per cent.; zinc, 18.6 per cent.

About 300 feet northerly from the portal of the lower crosscut another vein is exposed in a shallow cut by the side of the trail. This vein, which is about 2 feet wide, apparently has a north-westerly and south-easterly strike, but insufficient work has been done to ascertain the dip. The outcrop of this vein is considerably oxidized from the leaching-out of the sulphides. Some selected specimens of this oxidized outcrop material gave: Gold, 0.01 oz.; silver, 52.1 oz. With the exception of this shallow cut no work has been done on this vein.

The ore is carefully sorted and Bridge & Kennedy hoped to maintain an average of 600 oz. to the ton for the ore which they were sacking for shipment. Twenty-one tons was shipped to Trail in November.

Violet Group.* This property, consisting of the *Violet* and *Lookout* claims, owned by John Henry and J. M. Currie, of Ainsworth, is situated on the northern side of Woodbury creek at an altitude of about 8,400 feet (upper tunnel) near the summit of the divide separating that creek from the South fork of Kaslo creek. The claims are reached by a trail about 3½ miles in length which branches off the main Woodbury Creek trail at a point about 9 miles from Kootenay lake. Development-work done amounts to about 240 feet of tunnelling and a 60-foot raise.

The ore, consisting principally of grey-copper and silver sulphides, with small amounts of galena and pyrite, is found in siliceous stringers and bunches on the foot-wall side of a sheared zone in granite which strikes north-easterly along the summit of the divide. The hanging-wall is not clearly defined, but the lead appears to have a width of from 6 to 15 feet and almost vertical dip. Within the lead the granite is much altered in appearance, with highly siliceous phases.

Just below the summit a 50-foot tunnel has been driven on the lead. Sixty feet vertically below this level a tunnel has been driven 110 feet, partly as a crosscut and partly along the hanging-wall side of the lead. Fifty-four feet in from the portal of this tunnel a 10-foot crosscut has been made to the foot-wall of the lead, which was then drifted on for 15 feet to the north-east and 26 feet to the south-west. Near the extremity of the lower tunnel a raise connects with the upper tunnel.

The ore is carefully sorted for shipment, as packing charges from the workings to Kootenay lake are about $35 a ton. Grab samples of sorted ore gave:—Upper tunnel: Gold, 0.02 oz.; silver, 935.5 oz.; lead, 31.2 per cent.; zinc, 3.9 per cent. Lower tunnel: Gold, 2.02 oz.; silver, 90.1 oz.; lead, 33.5 per cent.; zinc, 1 per cent.

Wood for fuel has to be brought from over a mile away to the camp, but fortunately the ground in the workings requires scarcely any support. At the time of the writer's visit in September 4 tons of high-grade ore had been extracted and was awaiting shipment.

South Fork of Kaslo Creek.

Activities up the South fork have been confined to prospecting and a little development-work at the various properties, but no attempt has been made to ship ore, except from the *Silver Bell*, from which 45 tons is recorded.

M. S. Davys has had a few men employed at the *Silver Bear*, while adjoining claims have been prospected by L. McLeod.

Other minor activities include prospecting done at the *Liberty* under the supervision of W. Y. Williams, and a little development at the *Revenue* and *Gold Cure* groups.

Retallack.

Possibly one of the most important transactions which have taken place with regard to properties near Kaslo is the lease of the *Utica* to O. C. Thompson and associates, who for the past number of years have been successfully operating the *North Star* mine near Kimberley.

It is reported that under this lease the long crosscut tunnel which was started a few years ago will be continued to intersect at depth the two main veins. From the upper levels a considerable tonnage of high-grade ore has been extracted in the past.

At the *Mowhawk*, which is situated at a short distance from the *Utica*, J. Chisholm is driving on the vein in an endeavour to pick up the downward continuation of the ore-shoot below its outcrop.

Whitewater.—There has been an average of ten men employed at the mine. No new developments of any special significance have been made. About 200 tons of ore was shipped to the Bunker Hill smelter at Kellogg, Idaho.

SHIPPING-LIST, SHOWING APPROXIMATE TONNAGE MINED.

Mine.	Locality.	Weight.	Character of Ore.
		Tons.	
Bluebell	Riondel	3,450	Silver-lead.
Florence	Ainsworth	501	,,
Highland	,,	860	,,
Krao	,,	102	Silver.
Little Mamie	,,	11	Silver-lead.
No. 1	,,	183	,,
Ruth	,,	41	Silver (old concentrate).
Skyline	,,	21	Silver.
Spokane-Trinket	,,	22	Silver-lead.
Silver Bell	Kaslo	45	Silver.
Whitewater	Retallack	209	Silver-lead-zinc.
Utica	Adamant	46	Silver-lead.
Grant	Woodbury creek	2	,,
Jessie Bluebird	,,	21	,,
Violet	,,	4	,,
Mohawk	South Fork, Kaslo Creek	2	,,
Silver Bell	,, ,,	45	,,

SLOCAN MINING DIVISION.

In view of the depressed market conditions prevailing throughout the greater part of the year, there has been as much activity in the Slocan as could be expected.

Silversmith. A large crew was steadily employed during the summer months at construction-work. The old *Ivanhoe* mill, recently operated by the Rosebery-Surprise Mining Company, was acquired by the Silversmith Mines, Limited, remodelled and added to. A new aerial tram was constructed to connect the mill with the mine; this is equipped with the cable and buckets of the old *Centre Star* tram.

During the early part of the year the mine produced 2,021 tons of lead concentrates and 134 tons of crude ore. During this same period there was also produced about 2,000 tons of zinc concentrates which has not been shipped. No mining has been done since April 1st, pending the completion of the mill and tramway. It is expected that operations will be resumed in the near future.

Payne.—A certain amount of exploratory work, in the nature of crosscutting from the low-level workings, was done under the supervision of W. J. Elmendorff, a mining engineer of Seattle. It is understood that lack of capital caused the suspension of operations.

Rambler-Cariboo.—This property ranks as one of the steadiest producers of the Slocan. The company suspended operations this year and work was carried on by W. A. Cameron, the former manager, under the terms of a lease.

Queen Bess.—A few men have been steadily employed during the season by Clarence Cunningham.

McAllister. This property is owned by the Slocan Silver Mines, Ltd. R. A. Grimes, who is in charge, reports that the development-work done during the season includes 800 feet of drifting and raising in addition to surface exploration. The vein has been drifted on for over 1,000 feet on the No. 3 level, which is connected by three raises to the No. 2 level. By careful and systematic sampling he estimates that there is now a large tonnage of ore available, which will carry an average value of 33 oz. in silver to the ton.

Ruth. This property, including the *Ruth*, *Hope*, *Wyoming*, and *Ruth Fraction*, was one of the most important producers during the earlier history of the Slocan. It is owned by London interests, of which James Anderson, of Kaslo, is the local representative. The underground workings are extensive, while surface equipment includes an aerial tram and concentrator, the latter being situated alongside the railway. The vein is

of the typical fissure type of the Slocan. The ore-shoots as developed were strong and persistent along the strike.

During the period of inactivity in recent years the tunnels from the surface have in many places become caved, leaving only a comparatively small section of the old underground workings accessible. This year the property was leased to J. H. Black and associates, of Sandon, who started work in May and reopened the No. 3 level. Several nice shoots of galena were uncovered along the bottom of the drift and underhand stoping was commenced. The ore thus developed consisted of galena in crushed and decomposed ledge-matter heavily stained with oxide of iron. The true walls of the fissure are not definitely disclosed by the drift and more crosscutting than has been done would appear to be fully justifiable.

In the No. 2 level ore is exposed across a width of about 6 feet in the bottom of a crosscut and at a distance of 30 feet to the south of the main vein. A crosscut has been started from the No. 3 level to explore the ground under this showing. A grab sample from a pile of 35 tons extracted from these workings ran: Silver, 102.7 oz. a ton; lead, 65.2 per cent.; zinc, 3.2 per cent.

The following description of the discovery of this property, taken from W. A. Carlyle's report published in the Annual Report of the Minister of Mines for 1896, should be of interest to prospectors: "After many hardships and disappointments, but persistent prospecting, the *Ruth* vein was accidentally disclosed by a small piece or two of iron-stained rock sticking in the roots of a windfallen tree that had stood nearly on the top of the ledge, and even then considerable work had to be done before the ore-shoot was struck from which has since come the mine's production."

At the *Gem*, which is situated near Sandon, a small tonnage of high-grade silver-lead ore was extracted from the bed of Carpenter creek by Mickey Byrne, who bought the property from F. Edwards, the original owner.

Boulders and small nodules of all shapes and sizes of water-worn galena are found in the creek-gravels at the foot of an old slide. They are all well rounded and, to look at, resemble ordinary creek boulders and pebbles. No doubt they originally came from some ledge on the hillside, which, needless to say, has been carefully prospected, but the identity of the ledge is still uncertain.

Carnation Group.

Situated at an elevation of 6,000 feet at a distance of about 5 miles by trail in a south-westerly direction from Sandon. The group comprises the following claims: *Tenderfoot, Read, Carnation, Violet, Evening, Jennie, Jennie Lind,* and *Mollie O.* The claims are located on the northerly slope of Carnation mountain, from the summit of which one can look down on the mines of Silverton camp and Slocan lake, while an excellent view can also be obtained of the outstanding topographical features of the Slocan district. The area is well within the zone of mineralization and is underlain by rocks of the Slocan series, which have been intruded by granite-porphyry dykes from the near-by Nelson batholith.

Since the property was visited and reported on in 1917 a large amount of underground development and exploratory work has been accomplished under the management of G. W. Clark, of Sandon. Two substantial and well-built 16- by 24-foot cabins and a small stable have been erected.

The general strike of the vein is easterly and westerly, dipping to the south at an angle of from 50° to 71°. The No. 2 level consists of a drift 280 feet long, which develops the vein at a vertical distance of 200 feet below the surface exposures at the old shaft. The fissure-filling encountered in this drift is composed of oxidized and decomposed ledge-matter, in which occur small bunches and sprinklings of galena. Near the face the apparent width of this material is 24 feet. The hanging-wall is well defined and carries a streak of gouge; the true foot-wall had not been encountered at this point. It is promising-looking ground and the continuation of this drift for another 100 feet to explore the ground below the old shaft would appear to be justifiable.

The portal of the No. 3 level lies about 300 feet to the east of and about 200 feet below that of the No. 2. The total amount of drifting and crosscutting done in this level is about 600 feet. The hanging-wall is well defined and dips at an angle of 71° to the south. The filling of the fissure is brecciated and consists largely of siderite. The drift has not been extended far enough to prospect the vein under the last 200 feet of the No. 2 level.

Among other activities around Sandon during the season the following are reported: Johnson & McLanders were leasing at the *Mountain Con;* Bough & McLellan were working at the *Slocan Boy* on Payne mountain; the *Noonday* was worked under lease by Tattery & McDonald; and the *Freddy Lee* by Tatterie Bros. W. G. Clark, who had a few men working at the *Chambers* and *Carnation* groups, has recently taken a lease on the *No. 1.*

Mountain Chief. Situated on the wagon-road, half-way between New Denver and Alamo. The property, which is principally owned by A. W. McCune and the George Hughes Estate, is now being worked under lease by Frank Edwards and associates, of New Denver. It is one of the earliest-known properties of the Slocan and produced a considerable tonnage of high-grade silver-lead-zinc ore during 1892, 1894, and 1897. Since this latter date there are no records of any important production, which was possibly due to the increase of zinc with depth.

The vein, which strikes N. 25° E. and dips at about 45° to the south-east, cuts the steep hillside at an oblique angle; the most southerly outcrops are about 200 feet above the wagon-road, while those at the northerly end are some 500 feet higher up the hill. The formation consists of slate and limestones of the Slocan series. The vein has been faulted to the east in several places and the old workings have developed two distinctly separate ore-shoots—one near the southern end and the other near the northern, the latter being by far the most extensive. These workings are mostly caved in, but from what little that could be seen the vein has a width of from 3 to 10 feet where stoping has been done.

Several crosscuts driven from the surface tap the vein at no great depth, and from these drifting and stoping has been done, which constitute the principal workings. The most extensive work has been carried on from the upper level, from which the ore has been stoped to the surface in a number of places.

The dump represents a considerable tonnage, but it is so badly mixed with waste that it is doubtful if it could be reclaimed at a profit, although a small tonnage might be recovered by careful hand-sorting; for instance, a selected sample from this dump ran: Silver, 158.6 oz.; lead, 29.3 per cent.; zinc, 28.4 per cent. A sample taken from about 40 tons of ore piled near the portal of the lower tunnel ran: Silver, 49.3 oz.; lead, 7.6 per cent.; zinc, 27.1 per cent.

It is interesting to note than the zinc-blende in this vein invariably carries good silver values, and in this connection there is in all probability a considerable tonnage of zinc-blende available in the old workings, which was neglected when the property was being mined many years ago. A sample of zinc-blende of the typical "black jack" variety, taken from an exposure of 1 foot in width near the top of a shallow shaft, ran as follows: Silver, 39.4 oz.; zinc, 55.4 per cent.

Providing a suitable market can be obtained for zincky ores, the prospects of this property of again becoming an important producer would appear to be encouraging.

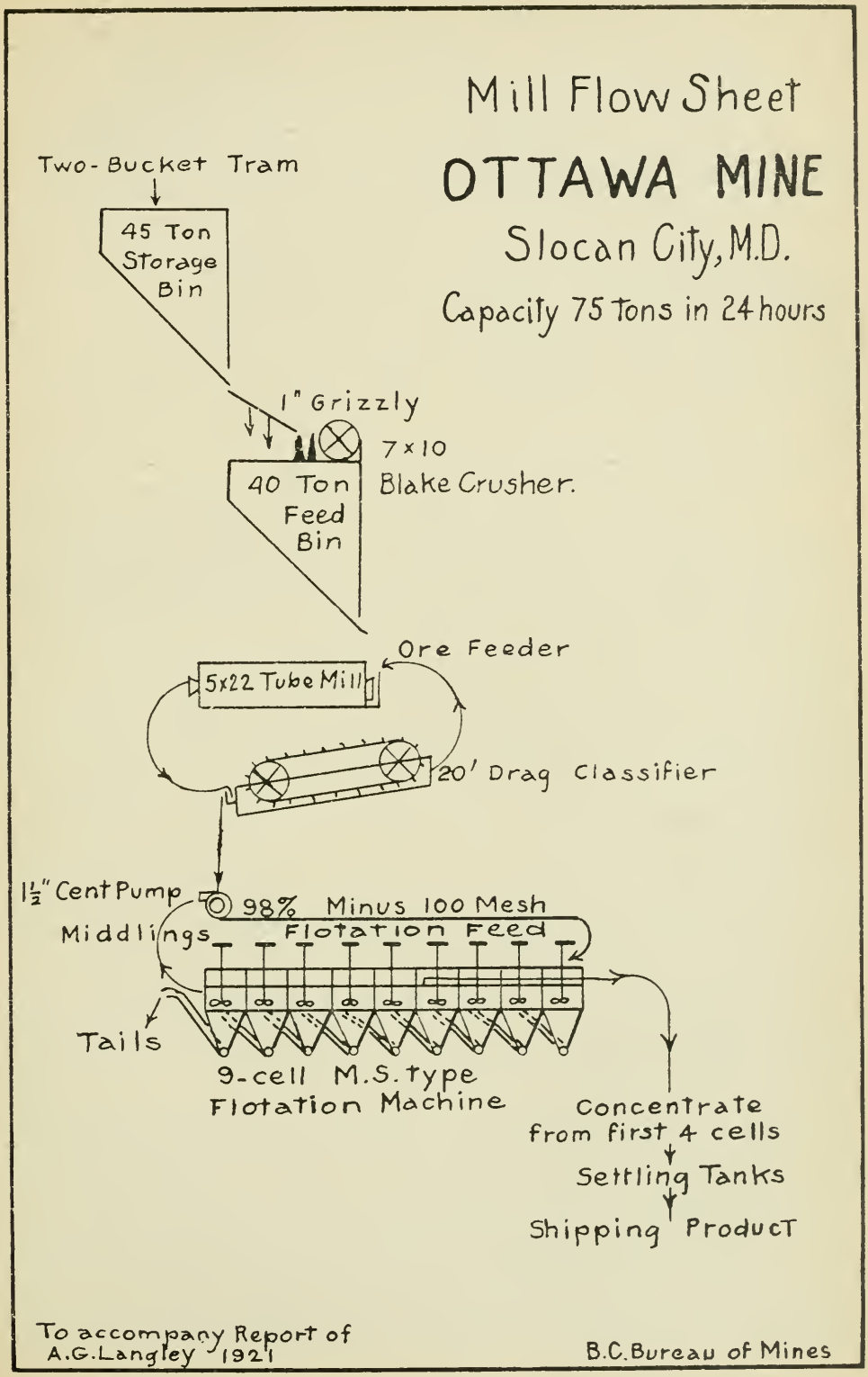
Bosun. This property has been operated steadily during the year by the Rosebery-Surprise Mining Company under the supervision of J. P. McFadden. The number of men employed averaged about twenty-five. During the first seven months of the year work was confined to development and exploration. Shipments were resumed on August 21st. The discovery of a parallel vein on the hanging-wall side between the Nos. 4 and 6 levels came at a most opportune time, and not only gave new life to the property, but has greatly increased its possibilities. At the time of the writer's visit on September 27th, ore was being stoped from this and the original vein between the fourth and fifth levels. The ore occurs in tightly frozen lenses in a slate formation, both as clean galena and zinc-blende. The galena carries about 150 oz. in silver and the zincky ore about 100 oz.

Mining was being done by hand, which was found in this case to be more satisfactory than the use of machine-drills. The ore is sorted before shipment, there not being a sufficient tonnage developed at the present stage of operations to warrant the starting up of the company's large mill at Rosebery.

Standard.—Operations have been suspended by the Standard Silver Lead Mining Company at this property, which is now being further exploited by Clarence Cunningham, who has had a few men at work during the season. Information regarding the nature of the transaction between Mr. Cunningham and the company has not yet been received.

Ottawa Mill, Slocan City M.D.

Ruth Mill, Sandon, Slocan M.D.


Mill Flow Sheet
OTTAWA MINE
Slocan City, M.D.
Capacity 75 Tons in 24 hours
Two-Bucket Tram
45 Ton Storage Bin
1" Grizzly
7×10 Blake Crusher.
40 Ton Feed Bin
Ore Feeder
5×22 Tube Mill
20' Drag Classifier
1½" Cent Pump
98% Minus 100 Mesh Flotation Feed
Middlings
Tails
9-cell M.S. type Flotation Machine
Concentrate from first 4 cells
Settling Tanks
Shipping Product
To accompany Report of A.G. Langley 1921
B.C. Bureau of Mines

SHIPPING-LIST, SHOWING APPROXIMATE TONNAGE MINED.

Mine.	Locality.	Weight.	Character of Ore.
		Tons.	
Silversmith	Sandon	668	Silver-lead.
Bosun	New Denver	256	Silver-lead-zinc.
Standard	Silverton	275	Silver-lead.
Van Roi and Queen Bess	Alamo	697	,,
Last Chance	Sandon	70	,,
Freddy Lee	,,	25	,,
Gem	,,	10	,,
Ruth	,,	108	,,
Molly Hughes	New Denver	27	,,
Rambler-Cariboo	Rambler	2,000	,,
Chambers	Sandon	6	,,
Echo	Silverton	5	,,
Majestic	Sandon	5	,,
Surprise	,,	4	,,
Canadian	Silverton	10	,,
Ivanhoe	Sandon	5	,,
Redress	,,	4	,,

SLOCAN CITY MINING DIVISION.

Ottawa.

This property is situated on Springer creek at an elevation of about 4,600 feet and at a distance of 5 miles by road from the railway at Slocan City. The history of the mine dates back to the early nineties, but apparently it was not until 1902 that extensive mining and development work was attempted. In this year the property was acquired by a Pittsburg syndicate, of which T. A. Noble was president and R. J. McPhee was mine manager.

In 1904 it is recorded that shipments amounted to 1,330 tons and the net profit for the year was $70,000.

In 1913 it was bought by the Consolidated Mining and Smelting Company, which worked it until 1918. Since then it has been worked under lease by P. McGuire and A. L. McPhee, who confined their attention during the first two years of the lease principally to sorting and shipping ore from the dumps.

In 1920 H. L. Biggar purchased a half-interest in the lease and mill-construction was started in September under his supervision, but owing to unavoidable delays it was not completed until August, 1921.

The ore-deposits occur in a sheared fissure in granite. The character of the ore-bodies would indicate that they owe their origin to replacement by the circulation of mineral-bearing solutions or vapours through small channels and filling interstices in the sheared material between the walls of the fissure, and that continuity might be expected with depth.

The ore occurs in lenses of considerable dimensions, the stoping width being as great as 8 feet. The ore is essentially a "dry" silver ore consisting of argentite, with which is occasionally associated small leaves of native silver, the latter, no doubt, being of secondary origin. The gangue is quartz and country-rock. In places barytes is the predominant gangue and is invariably associated with high values. It is both a difficult ore to sort and to recognize underground, as often lean-looking material will run well in silver.

In the past only the highest-grade ore was shipped owing to the difficulties presented by the concentration of the silver minerals. Hence the dumps contain some high-grade and a considerable tonnage of second-grade ore, while there is a possibility of winning a fairly large tonnage of mill-feed from the old stope fillings.

The fissure dissects the hillside in a northerly and southerly direction and dips at 37° to the east. The mine has been opened by five adit-tunnels at vertical intervals of 100 feet. The uppermost, or the No. 1, is the old original prospect-tunnel and is no longer of any consequence. The Nos. 2, 4, and 5 are in good condition and the No. 3 is caved. Below the No. 5 there is still another level, the No. 6. This does not come out to the surface and is now full of water. It is interesting to note that the ore-shoots showed a marked increase in size as depth was gained.

The ore has been stoped out above the No. 5, although there are places from which small tonnages can be mined, while further prospecting on the hanging-wall side may reveal the presence of parallel shoots. By a rough estimation the dumps contain about 25,000 tons, in which the values are bound to be "spotty." In order to arrive at an estimate of the tonnage suitable for mill-feed extensive and costly sampling would have to be undertaken. Shipments made so far have been encouraging; for instance, 700 tons shipped in 1919 averaged 19.8 oz. in silver, while another 700 tons recently treated by the mill averaged 12 oz. in silver.

The mill is on Springer creek, at an elevation of about 1,000 feet below the No. 5 tunnel. It is supplied by a 2,000-foot 2-bucket tram, the upper terminal of which is on a level with the bottom of the No. 5 dump. The rated daily capacity of the mill is 50 tons. The flow-sheet is as follows: The tram discharges into a 45-ton storage-bin; the ore is then fed over a 1-inch grizzly to a 7 by 10 Blake crusher; then to a 40-ton feed-bin, from which it is fed direct to a 5- by 22-foot tube-mill; the discharge from this goes to a drag classifier; the oversize is kept in closed circuit with the tube-mill and the overflow constitutes the feed for the flotation-machine, it being 98 per cent. minus 100 mesh. The flotation-machine is a 9-cell M.S. type. Concentrates are taken off from the first four cells; the remaining five cells make middlings which are kept in closed circuit with the machine. Tailings made in the last cell go to waste. The plant is run by water-power developed from Springer creek under a head of 290 pounds. The average power used is about 100 horse-power.

Some little delay was caused by the silex liner of the tube-mill and difficulty was experienced in getting suitable pebbles, so it was decided to insert a steel liner and replace the pebbles with steel balls. This change has resulted in increased efficiency.

The first shipment of 20 tons of concentrates was made on November 9th. This contained 308.5 oz. of silver to the ton and gave net returns of $3,989.48. The ratio of concentration for this shipment was about 35 to 1 and the average values in the feed were 12 oz. in silver to the ton. The cost of reclamation and treatment of the dumps is estimated at $2 a ton. The crew consists of twelve men, six of whom are employed at the mill.

This is the first attempt made in the district to concentrate this class of ore, and the results will have an important bearing on many of the properties in the "dry ore" belt.

Tamarack.

This property adjoins the claims of the *Ottawa* group to the west and comprises the following claims: *Tamarack*, *Falls View*, and *Essie*. Malcolm Cameron, of Slocan, who is a part owner, has been engaged at development-work during the year. The vein occupies a sheared fissure in granite, dipping at an angle of 30° to the south and striking due east. The ore is a "dry ore" similar to that of the *Ottawa*.

In 1905 extensive drifting was done on the vein by three adit-tunnels at vertical intervals of 80 feet. The uppermost, or No. 1, has been driven at an elevation of 4,600 feet or about 1,200 feet above Springer creek. It consists of a drift 206 feet long. The vein is continuous for the whole length of the tunnel. Recently ore was struck near the end, where the vein widens, and carries a pay-streak of from 18 to 24 inches. A composite sample taken at the face across these widths gave the following returns: Silver, 32 oz. This ore extends back into the drift for about 10 feet, when the vein becomes narrower and the filling more mixed.

The No. 2 tunnel, which is in 270 feet, only developed ore near the portal. A few car-loads were extracted from this shoot during the early history of the property and the ore was followed by a raise to the No. 1 level, above which it was continued for 45 feet. The remaining values at this point are confined to small streaks and pockets. A sample across narrow widths ran: Silver, 43.8 oz.

No ore was developed in the No. 3 tunnel, which is in about 330 feet. In this tunnel a fault-fracture was encountered. The walls are slickensided and the filling consists of crushed and decomposed granite.

The results obtained by recent work in the No. 1 tunnel are encouraging, more especially since it has recently been demonstrated that this class of ore is amenable to concentration by the flotation process. At present hand-sorting and cobbing is necessary before shipment. This is expensive, as the ore is both difficult to sort and extremely tough and hard to break.

Arlington.

This property is situated near the head of Springer creek at a distance of about 8 miles by road from Slocan. It is owned by the Rithet Estate in Victoria. The claims were staked as early as 1894 by C. E. Fielding. According to the only old records available, the mine reached its apex of production in 1901, when it

headed the list of Slocan shippers with a production of 5,283 tons for the year. In 1904 the mine was temporarily closed down and reopened in 1905. Steady production was maintained until 1908. The ore shipped is reported to have averaged about 75 oz. in silver and 5 per cent. lead to the ton.

In 1918 M. S. Davys, of Kaslo, took a lease on the dumps, from which he shipped some 500 tons. The ore was not carefully sorted and the values proved disappointing. The ore, consisting of grey-copper, antimonial sulphides of silver, and a little galena, is reported to have occurred in narrow lenses, stringers, and "kidneys" throughout a crushed zone in granite having a width in places of 70 feet. In order to win this ore it was necessary to mine a large percentage of second-grade material which would not stand shipment and had to be hand-sorted. The dumps give evidence of this method having been resorted to. Failure to find a suitable method of concentration during the period of operation was probably the primary cause of closing down.

The mine was opened by three adit-tunnels—namely, A, B, and C. A level gained a vertical depth of 150 feet below C; B level was driven at 100 feet above A. The principal stoping was done betwen B and C levels; on the former, according to old maps, it is continuous for over 1,000 feet along the strike of the deposit. A level is caved and partly full of water. Some of the old workings are still accessible from B level, in which several small lenses of good ore are exposed.

In reviewing the data from old records it is evident that a large tonnage was produced in proportion to the amount of development-work done in the ore-bearing zone. The occurrence of ore throughout a wide zone of shearing would suggest that more crosscutting might have been done to advantage, while there is no reason to suppose that the ore pinches out below the 150-foot or A level.

For the successful operation of this property, providing sufficient ore is developed, a concentrator would seem to be a necessary adjunct. To reopen the mine with a view of again placing it on a productive basis, it would be necessary to clean out and retimber A tunnel, from which level further exploratory and development work could be carried on.

R. R. Hedley, who acquired a lease on the property this year, has been engaged in investigating such of the old workings as are accessible and sampling the dumps, which contain by a rough estimate some 10,000 tons. The results of a number of assays of ore picked from the dumps indicate that it cannot be hand-sorted profitably, as that carrying high silver values closely resembles low-grade ore, and vice versa.

Silver Crest Group.*

This group, consisting of the *Silver Crown*, *Silver Banner*, *Silver Bugle*, *Silver Crest*, and *Silver Bell* claims, is situated along the precipitous summits on the southern side of the headwaters of Lemon creek, about 17 miles by road and trail from Kootenay lake (8 miles by the old wagon-road up 6-Mile creek from Willow Point; thence about 9 miles by trail up Lemon creek). The property can also be reached by the trail up Lemon creek from the Slocan River valley, which route is also about 17 miles in length. The claims, which are recorded in the name of H. G. Harding, secretary of the McLeod-Slocan Mining Syndicate, formerly constituted the *German* group, abandoned by the owner, Henry Reichert, when he left the country in 1916. Reichert was responsible for most of the work done on the property (chiefly open-cuts). R. G. McLeod (president of the syndicate) and associates did some work stripping the outcropping of the vein on the *Silver Crest* claim in the summer of 1921.

At the time of the writer's visit there were eight men in addition to Mr. McLeod and his family at the property. A few of the men were employed in making an open-cut in the lead on the summit of a precipitous bluff at 8,500 feet altitude. This bluff falls abruptly for 1,400 feet towards Lemon creek and the workings are reached by a roundabout route which culminates in the glacial basin behind and a few hundred feet below the summit. From the cabin at about 6,800 feet altitude it takes over an hour of stiff climbing to get to the workings.

The mineralization occurs in a fissure-vein in granite. A basic micaceous dyke follows close to the vein on the hanging-wall side. The strike of the vein conforms to the trend of the summit of the mountain (north-easterly and south-westerly) and the dip is steeply into the mountain, or south-easterly. The vein varies in width from 10 to 12 inches where exposed in the open-cut and the wall-rocks are rusty-looking and decomposed for several feet. The associated minerals are pyrite and galena carrying gold and silver values in a gangue of decomposed quartz and

granite. A sample across 10 inches gave: Gold, 1.82 oz.; silver, 18.1 oz.; lead, 7.6 per cent. The comparatively high gold values may be due to a local concentration of the metal from oxidation of the pyrite. On account of its inaccessibility exploitation of the outcrop will be difficult and a considerable outlay will be necessary before the property can be brought to a producing stage.

White Heather.* This claim, situated at the bottom of the mountain on which the *Silver Crest* group is located, was formerly part of the *German* group, but was recently relocated by J. Law and T. Armstrong. At an approximate elevation of 7,200 feet an open-cut has been made in the outcrop of a lead striking northerly and southerly and dipping about 60° easterly, or into the mountain. The material exposed in the open-cut is oxidized and decomposed, resembling ledge-matter.

About 100 feet vertically below the open-cut a 150-foot crosscut tunnel intersects the lead, which was drifted on for 300 feet southerly. Here the lead, 5 to 6 feet wide, is composed of siliceous porphyritic rock containing stringers and bunches of oxidized material which carry values in silver and gold. The only ore-mineral noted was pyrite. Selected specimens of this oxidized material gave: Gold, 0.04 oz.; silver, 15.6 oz.

About 40 feet vertically below and a short distance from the above tunnel an open-cut has been made in a 6-inch quartz vein having an approximately similar strike and dip. In this vein the quartz is considerably leached, but a little galena and pyrite were noted. A sample across 6 inches gave: Gold, 0.22 oz.; silver, 9.2 oz.; lead, 0.1 per cent. Sixty feet vertically below this open-cut a 60-foot crosscut encountered the vein, which at this point only amounted to a seam, no drifting being done.

Soldier Boy.* This claim, owned by J. Law and T. Armstrong, is situated about half a mile south-westerly from the *Silver Crest* group on the same mountain. Siliceous stringers containing silver sulphides occur in a sheared fissure in granite. This fissure, of indeterminate width, strikes almost vertically across the mountain towards the south-east, or approximately at right angles to the trend of the summits. As the lead outcrops up the face of a precipitous bluff, work has been confined to the only two accessible points, which are the top and bottom of the bluff. The upper workings are reached by a circuitous route over the rugged ground south-west of the bluff.

At the top stringers of ore are exposed in open-cuts at elevations of 7,875 and 7,850 feet. An average sample of 3-inch pay-streaks in these open-cuts gave: Gold, 0.04 oz.; silver, 72.9 oz. About 25 feet vertically below the lower of these cuts a 70-foot crosscut just reaches the lead, which was not drifted on. This tunnel was driven at great personal risk to the owners, who lowered themselves to work on a rope with powder, steel, and timbers.

Below the portal of the tunnel the bluff falls almost vertically for 1,400 feet towards Lemon creek. At the bottom of the bluff, at 6,400 feet elevation, stringers of ore are exposed in an open-cut. Specimens of ore from this cut gave: Gold, 0.46 oz.: silver, 73.7 oz.

Barnett Group. This group, which originally consisted of the *Barnett*, *Little Montana*, and *Pulaski* Crown-granted claims, is situated at an approximate elevation of 6,600 feet on the northern side of Lemon creek, a little to the west of its intersection with the Third North fork. To get to the property the route followed is from Willow Point, on the West arm of Kootenay lake, 8 miles by the old wagon-road up Duhamel creek; thence via Oro up the Lemon Creek trail about 7 miles; thence up a branch trail 1¼ miles, making the total distance from transportation about 16¼ miles. The property can also be reached by the Lemon Creek trail from the Slocan River valley, which route is about the same length.

The property was examined following an application for assistance towards cost of making repairs to the trail leading to it. R. G. McLeod and associates did a little work on the *Barnett* claim in the summer of 1920. This work chiefly consisted in driving a short length of tunnel. The old workings, which date back to the early days of the camp, consist of some short tunnels, open-cuts, and trenching.

The mineralization occurs in a flat-lying quartz vein in granite. Adjoining the vein the country-rock is rusty-looking, soft, and decomposed. The vein will average about 15 inches in width, but good values are also obtained from a band of altered porphyritic granite in the foot-wall of the vein, which band varies in width from 6 to 12 inches or more.

The ore-minerals noted were pyrite, argentite, and "black sulphurets." The ore so far exposed is chiefly found within a length of 200 feet along the outcrop of the vein, which follows the contour of the hill in a northerly and southerly direction. Three short tunnels crosscut this ore-shoot, but the vein is so flat that it remains in the tunnels throughout their entire length (the longest tunnel is 150 feet in). There are patches of ore in all three tunnels. On account of the soft, decomposed nature of the granite considerable timber is required to support the roof. The winning of ore from a small vein under these conditions is difficult and expensive.

Samples taken gave as follows:—Selected specimens of quartz containing "black sulphurets": Gold, 0.42 oz.; silver, 52.3 oz. Grab sample from small pile of sorted ore: Gold, 0.79 oz.; silver, 74.2 oz. Sample across 6-inch band of porphyritic granite in the foot-wall of the vein: Gold, 0.68 oz.; silver, 141.9 oz.

Laboratory tests show the ore to be well adapted to the flotation process, but a considerable outlay will be necessary on development with a view to assuring the ore-supply which would warrant the installation of a small plant.

Black Prince.—Situated at a distance of 9 miles from Slocan and operated by J. T. Tipping. The property has been a small but steady producer for a number of years. The principal values are in silver.

Anna.—Situated near the *Ottawa* on Springer creek. The property is owned by K. Zimmerman, who operated it during the early part of the year and made a small shipment to Trail. The ore is the characteristic "dry ore" of this district and carries high silver values.

L.T. Group.—Situated at about 3 miles from the *Ottawa*. D. B. O'Neail, of Slocan, who is the principal owner, put in a season's work at the property.

Hampton.—Situated near the head of Springer creek and worked under lease by Barber, Wafer & Moran. The results of the season's work were encouraging and development will be continued during the winter months.

SHIPPING-LIST, SHOWING APPROXIMATE TONNAGE MINED.

Mine.	Locality.	Weight.	Character of Ore.
		Tons.	
Ottawa	Springer creek	1,440	Silver.
Anna	,,	20	,,
L.T.	,,	11	Silver-lead.
Black Prince	Lemon creek	51	,,

NELSON MINING DIVISION.

There has been more than usual activity among the gold properties of this Division during the past season, though most of the work has been confined to prospecting and development, the results of which it is hoped will be manifested in the near future by additional mines on the shipping-list.

The principal source of production has been from the Nugget Gold Mines, Limited.

The principal lead-producers of the Division—namely, the *Molly Gibson* and the *Emerald*—have experienced a quiet season. The former property, which belongs to the Consolidated Mining and Smelting Company, has been leased to W. A. Cameron, who intends to employ a small crew of men at the mine this winter. During the summer the aerial tramway was partly destroyed by fire.

Nugget Gold Mines.

Harold Lakes, the manager, reports that milling operations commenced on April 28th and ceased on November 1st. During this time 10,920 tons of ore was mined and milled; the estimated recovery is $68,637. The average number of men employed when running at capacity was forty at the mine and fifteen at the mill, which latter included office staff, superintendent, assayer, etc. During the winter eight men will be employed at development of the *Nugget* vein.

Reno.

W. B. Pool, who for a number of years has been systematically uncovering a series of gold-quartz veins by trenching and open-cuts, has now formed the Reno Gold Mines, Ltd., of which he is president, T. Kilpatrick vice-president, and James O'Shea secretary. The capital of the company is $1,000,000, divided into non-

assessable shares of $1 each. It is understood that the intention is to first prove the veins at depth by drifting from the surface and crosscutting; then, if results are satisfactory, to install the necessary plant for mining and treatment of the ore.

Bayonne.—This property is under option to John B. White and associates, of Spokane. About 15 tons of winter supplies have been packed in over the Sheep Creek trail from the end of the wagon-road at the *Motherlode* mill. About ten men will be employed through the winter under the management of B. N. Sharp. The ore is gold quartz occurring as a fissure-vein in granodiorite.

Spokane Group.—Situated near the head of Canyon creek. As a result of steady work extending over a number of years, Laib Bros. (the owners) now have a considerable tonnage blocked out. The principal values are in gold and silver.

California-Athabasca.—These properties are being operated by the California Mining Company. Further improvements have been made to the mill and it is confidently expected that the property will be on the shipping-list next year.

Granite-Poorman.—This well-known property was acquired early in the year by the Granite-Poorman Mines, Limited, in which A. C. Bowness and associates are principally interested. Underground and surface exploration have been steadily proceeded with. During the winter it is proposed to do an additional 50 feet of tunnelling and 250 feet of raising under contract.

Gold Hill.—This property has been worked for the last two seasons by George Gormley. During the year 96 tons of ore was shipped to Trail. The principal values are in gold and copper, the former occasionally running as high as 5 oz. to the ton.

Champion.—Situated near Park Siding, on the Great Northern Railway. S. N. Ross put in a season's work at the property. A shipment of 20 tons of gold-quartz ore was made to Trail.

Monarch.—Situated near Hall, on the Great Northern Railway. J. Fisher has taken in a diamond-drill outfit with the intention of working during the winter.

Silver Reef Group.

This property, comprising a group of four claims—namely, the *Rover*, *Silver Reef*, *Butte City*, and *Pictou*—is owned by W. J. Richards, of Nelson. The claims cover an area between the two forks of Anderson creek and are conveniently situated to the Great Northern Railway at a point about 3 miles east of Nelson. Good water for camp purposes and timber for mining are available in the immediate vicinity of the workings.

The vein, which has a strike of N. 20° W. and an almost vertical dip, cuts a formation of granodiorite which forms a rounded ridge between the two small branches of the creek. It is a well-defined true fissure-vein in which the typical banded structure is well developed. The vein-filling is of white quartz in which the ore occurs in two distinct bands, presenting a ribbon-like structure.

Some years ago a drift was run in a southerly direction from the bank of the North fork, developing good backs and establishing the continuity of the vein for 260 feet. The average width is apparently about 2 feet, though this could not be accurately determined, as the vein could only be seen at intervals through the lagging. The granite on the west wall is soft and decomposed, while on the other wall it is more massive.

At a point 260 feet from the portal there has been a movement which has somewhat complicated matters, and for 70 feet the vein swings to the east and is not so strongly defined, leaving doubt as to whether it is the true continuation of the vein. A lamprophyric dyke which seems to follow the line of fissuring is noticeable, and at the face of the drift forms both walls of the vein. In the opinion of the writer the continuation of the vein at the end of the drift will probably be found to lie between the granite and the dyke; the latter, being post-mineral, may have either caused faulting or splitting of the vein; hence a little crosscutting near the end of the drift would seem advisable, or, if the overburden is not too great, trenching vertically above the change in direction of the vein should be a valuable guide to future underground work.

At a point 200 feet from the portal the vein has been stoped to a height of about 35 feet above the tunnel. This stope has a length of about 35 feet. A composite sample across an average width of 8 inches from three different places up the ladderway gave the following results: Gold, 0.12 oz.; silver, 4.8 oz.; lead, 14.5 per cent.; zinc, 11.7 per cent.

The ore consists principally of a mixture of coarsely crystalline galena and zinc-blende, carrying values in gold and silver.

Humming Bird.* This group, consisting of the *Humming Bird* and *Queen Elizabeth* claims, owned by Robert Qua and R. G. Joy, of Nelson, is situated at the head of 5-Mile and Roaring creeks at an elevation of from 5,400 to 5,600 feet. To get to the claims the present route is by a trail about 10 miles in length from the Mountain Station at Nelson. This trail, which contains many steep pitches and adverse grades, follows the heights on the eastern side of Cottonwood creek, more or less parallel to the Great Northern Railway, whereas a much easier trail about 4 miles in length could be constructed down Roaring creek to connect the property with Apex.

The geological formation of the area embraces slates, phyllites, and schists, in which bands of quartzite and limestone occur; the whole being classified as the Nisconlith series. To the south and south-east of the series there is an extensive belt of granite. In the immediate vicinity of the workings the country-rocks are quartzite and siliceous schist.

Following the discovery of some rich gold-bearing float in the bed of a small creek (tributary to 5-Mile creek just below the watershed separating that creek from Roaring creek), the owners did considerable ground-sluicing in heavy wash, which resulted in the uncovering of segments of two parallel veins a little above the creek-bed.

The veins are well defined between smooth walls conforming to the stratification of the enclosing rocks, which dip at about 39° towards the south-east, or into the hill. The associated minerals are galena, zinc-blende, pyrite, and arsenopyrite, with some free gold, in a quartz gangue.

High gold values are associated with the arsenopyrite, which fills small cavities and vugs in the quartz, while appreciable amounts of coarse gold can be panned from quartz which shows a layer-like or "ribbon" structure. There is generally little oxidation in evidence to which local concentration of the metal could be attributed, even barren-looking quartz giving colours on panning.

The upper vein, from 1 to 2 feet in width, is partially exposed along its outcrop for a distance of 100 feet, with an open-cut at the north-east end and a 10-foot incline shaft at the south-west end. The open-cut is in an ore-shoot of which a length of about 10 feet is exposed so far (heavy overburden covers the north-easterly continuation of the ore-shoot). An average sample across 2 feet in the open-cut gave: Gold, 6.26 oz.; silver, 3.9 oz.; lead, 5.5 per cent.; zinc, 1.9 per cent. Selected specimens of quartz and arsenopyrite from the same place gave: Gold, 3.14 oz.; silver, 2.3 oz.; lead, 2.4 per cent.; zinc, 0.4 per cent.

The lower vein, which is about 50 feet from and a little below the upper vein, is about 30 feet vertically above the creek-bed. Segments of this vein, exposed in two open-cuts 50 feet apart along its outcrop, show an average width of 1 foot. In these cuts the quartz is sparingly mineralized, but further work along the strike may disclose an ore-shoot.

The showing in the open-cut on the upper vein is very attractive and may be the commencement of an ore-shoot of appreciable length. The prospect has many natural advantages, situated as it is at a comparatively low altitude, within easy reach of the railway (if a trail is built to Apex), and having a plentiful supply of timber for mining purposes close at hand, while water-power could probably be cheaply developed on Roaring creek at a short distance from the claims.

Big Porcupine.* This claim, same owners, is situated above the *Humming Bird* group at an elevation of about 6,300 feet (cabin). Two parallel quartz veins, containing bunches of silver-lead ore of the concentrating type, cut the granite in an easterly and westerly direction, with average dips of about 30° to the north. The veins vary in width from 4 to 7 feet and are about 300 feet apart (roughly estimated), being developed by two shallow incline shafts and some open-cuts, in which is exposed some galena, zinc-blende, and pyrite disseminated through the quartz. No samples were taken by the writer, but assays are said to have returned as high as 40 oz. silver to the ton.

United Verde.* This property (formerly the *Southern Belle*), consisting of the *Melrose*, *United Verde*, *Victoria*, *Silver Tip*, and *Jessie* claims, owned by the Trail Mining Company (J. Rozeck, superintendent), is situated on Wilson creek about 3 miles by trail from the end of the wagon-road at the Lost Creek bridge, or a total distance of 12 miles from Salmo. The old workings are described on page 172 of the Report of the Minister of Mines for 1918. In this year the *Southern Belle* group and adjoining claims were acquired by

Kitchener—C.P.R. Iron Properties.

Kitchener—C.P.R. Iron Properties—Diamond-drill Hole.

the present owners from C. E. Wilson, of Salmo. Since then considerable work has been done, including about 675 feet of tunnelling (up to the time of the examination in May, 1921).

The new work consists of a 600-foot crosscut, gaining a depth of several hundred feet on the old workings, and some drifting on the leads. The crosscut intersects two parallel quartz veins which strike N. 50° E., with dips varying from 70° to 76° to the south-east, or into the mountain.

The principal lead, encountered in the crosscut at 580 feet from the portal, is 15 feet wide, between smooth, clearly defined walls, from which the ore breaks freely. Galena is irregularly disseminated in bunches and stringers throughout the entire width of the lead, which was drifted on for 30 feet. This drift, widened to the full width of the vein, showed mineralization throughout, with ore in both faces. A sample across 15 feet gave: Gold, 0.08 oz.; silver, 12.9 oz.; lead, 21.6 per cent.; zinc, 1.3 per cent. According to recent reports this drift has since been continued some distance with good results.

From the intersection of this big vein in the crosscut to its outcrop there is an estimated depth of 375 feet of stoping-ground. The other vein, which amounted only to a stringer where encountered at 360 feet from the portal, widened out to 30 inches when drifted on for a short distance. A sample across 30 inches gave: Gold, 0.06 oz.; silver, 4.3 oz.; lead, 8.2 per cent.; zinc, 5.4 per cent. From the intersection of this vein in the crosscut to its outcrop there is an estimated depth of 250 feet of stoping-ground. A further depth, roughly estimated at 600 feet, could be gained on the present lowest workings by tunnelling.

The company has acquired water rights for power purposes on Wilson creek and the South fork of the Salmon river with a view to the erection of a small concentrator.

High Ore.*

This property, consisting of the *Good Hope*, *Gold Note*, *Free Gold*, *High Ore*, and *Mika Chaka* claims, owned by Alec. Long, of Nelson, is situated at an elevation of about 3,500 feet (cabin) on the mountain-slope about three-quarters of a mile westerly from Eagle creek, and is reached by a trail about 1 mile in length which branches off the upper *Granite* road at Eagle creek. The total distance from Nelson to the claims is about 6 miles.

Two parallel quartz veins cut the granite formation in a southerly direction, or straight up the mountain, dipping at about 60° to the east. The veins, which are about 250 feet apart, vary in width from 6 inches to 2 feet.

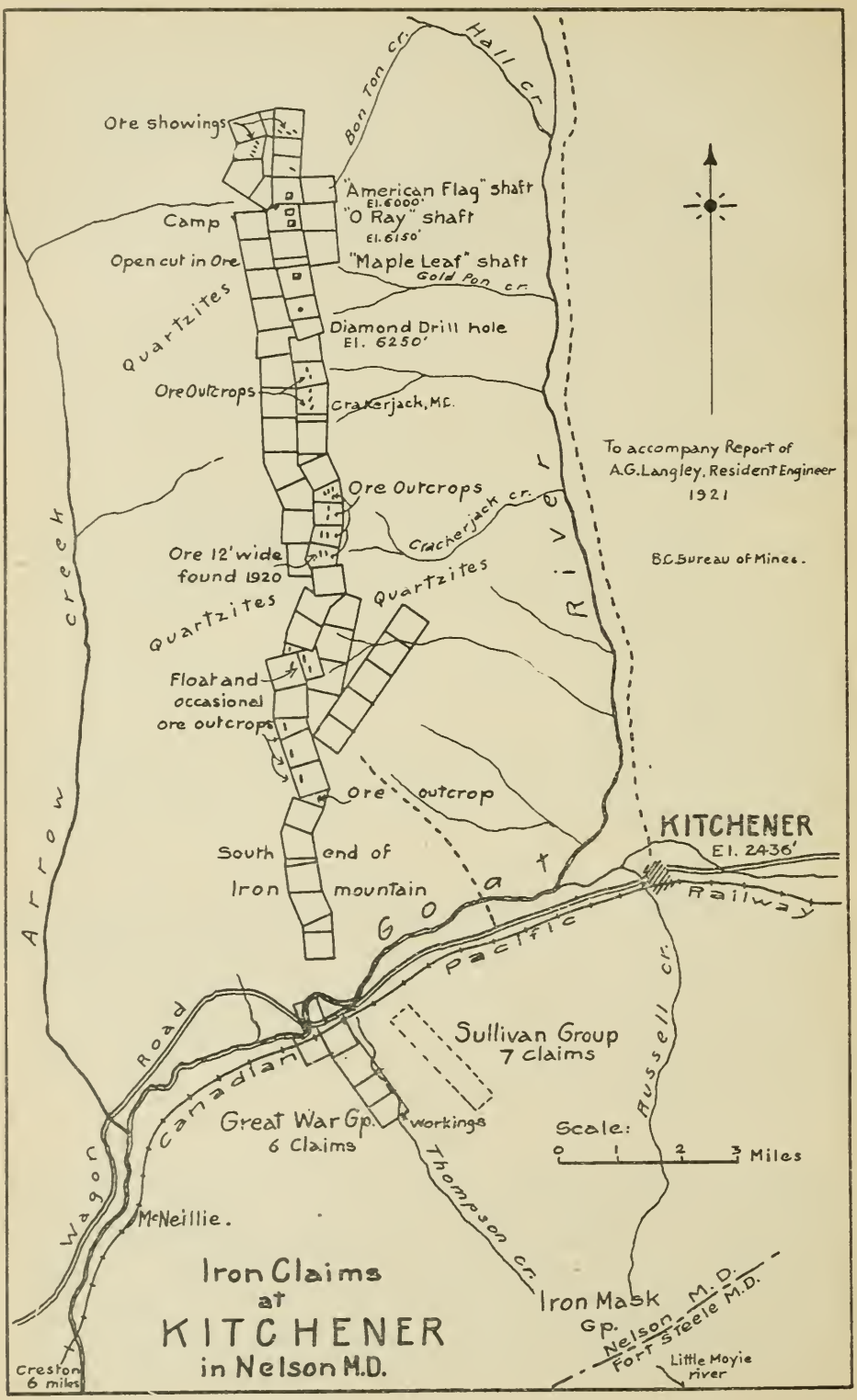
Free gold occurs chiefly in the leached and oxidized portions of the veins, which have been opened up for several hundred feet along the surface by means of short tunnels and open-cuts. Six samples taken at different points across widths varying from 6 inches to 2 feet gave an average value of $6.20 in gold to the ton. The highest values are probably confined to streaks and lenses in the veins.

Kitchener Iron-deposits.

A long string of claims comprising four groups cover an iron-bearing zone, which crosses the Crowsnest Pass Railway at a point near Kitchener and extends in a northerly direction, paralleling Goat river for a distance of approximately 8 miles. The *Great War* group, owned by the British Columbia Iron Company, and the *Iron Mask* group, owned by R. Lamont and associates, of Creston, lie to the south of the Crowsnest Pass Railway and extend to the headwaters of the Little Moyie river. Another group, known as the *C.P.R.* group, covers all of the principal surface showings north of the railway and extends some 8 miles up Goat river. Adjoining these claims there is still another large group owned by C. P. Hill. On this latter group very little prospecting has been done so far.

Geology.

This area is underlain by quartzites which have been classified by Dr. S. J. Schofield, of the Geological Survey, as belonging to the Aldridge formation of Pre-Cambrian age. These rocks have been intruded by a wide dyke of diabase, distinctly green in colour and varying in texture from a granitoid to a finely crystalline rock. It can be easily distinguished in the field from the more common diorites and gabbros forming the Purcell sills. It outcrops at intervals along a persistent strike of about N. 10° W., sometimes forming big masses of over 1,000 feet in width and at others forming dyke-like intrusions. The quartzites show many variations in dip and strike, and in places where there has been intense shearing have been converted to rocks resembling chloritic schists along a narrow margin of their contact with the green igneous rock.


Ore showings
Bon Ton cr.
Hall cr.
"American Flag" shaft
El. 6000'
"O Ray" shaft
El. 6150'
Camp
Open cut in Ore
"Maple Leaf" shaft
Gold Pan cr.
Quartzites
Diamond Drill hole
El. 6250'
Ore Outcrops
Cracerjack, Mc.
To accompany Report of
A.G. Langley, Resident Engineer
1921
B.C. Bureau of Mines.
Ore Outcrops
Cracherjack cr.
Ore 12' wide
found 1920
Quartzites
Quartzites
Quartzites
Float and
occasional
ore outcrops
Ore outcrop
KITCHENER
El. 2436'
South end of
Iron mountain
Railway
Pacific
Sullivan Group
7 claims
Canadian
Great War Gp.
6 Claims
workings
Scale:
0 1 2 3 Miles
Russell cr.
Wagon Road
McNeillie.
Thompson cr.
Iron Claims
at
KITCHENER
in Nelson M.D.
Iron Mask
Gp.
Nelson M.D.
Fort Steele M.D.
Little Moyie
river
Creston
6 miles

This is noticeable at the head of Thompson creek. The diabase has also been subject to shearing and has been altered to chloritic schists in certain localities. Owing to the hillsides being covered with brush and overburden the lateral boundaries and continuity of the diabase have been difficult to trace, and further prospecting may yet reveal that it covers a far greater area than the present exposures would indicate.

The important feature of this intrusion, from an economic standpoint, is that hæmatite is found to occur always associated with the diabase, either in the rock or near its contact with the quartzites. The largest bodies of hæmatite so far discovered occur along the contact of the quartzite and dyke and constitute wide bands of high-grade hæmatite, which gradually grade into lean siliceous ore, due to the process of replacement of the quartzite wall.

In places the hæmatite forms a matrix of a siliceous breccia; it also forms veinlets both in the quartzite and dyke-rock. Taking these facts into consideration, and as both the quartzites and dyke-rock show evidence of shearing, it would seem reasonable to assume that subsequent to the intrusion of the latter a zone of fracturing was formed having a northerly and southerly trend and closely following the line of contact. That channels were thus provided for the iron-bearing solutions and ore-bodies were formed along the line of least resistance, both in the quartzite and diabase. The iron, probably originating from the same magma as the dyke-rock, represents a different phase of its mineralization.

C.P.R. Group.

This property, comprising thirty-two Crown-granted claims, extends from a short distance north of the Crowsnest Pass Railway for about 8 miles up Goat river. The group consists of Lots 5765 to 5787 (inclusive), 5790 to 5795 (inclusive), and Lots 5835, 5839, and 5840. Registration is in the name of the Royal Trust Company. The claims are staked along the summit of the ridge which forms the divide between Goat river and Arrow creek. On the easterly side the slope of the ridge is dissected by small creeks. These terminate in basins at 1,000 feet or so below the summit, leaving bluffs and escarpments above. On the western side the slopes are more uniform and gradual. The elevation of the surface exposures, on which most of the work has been done, is about 6,000 feet, or some 3,000 feet above Goat river.

Past History.—The claims were originally located in about 1899 by C. P. Hill and were bonded to the London and British Columbia Gold Fields, who primarily confined their attention to prospecting for copper. At this time, probably due to the Rossland excitement, it may be noted that every iron-capping in the country was staked, not for iron, but for the possibilities of finding copper beneath the iron-stains, so this particular area proved an attractive field for the prospector.

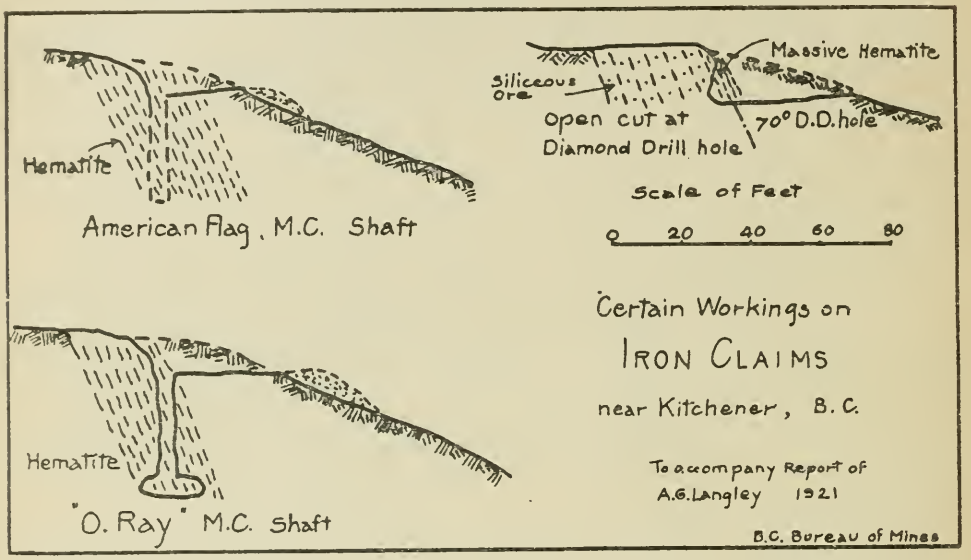
In 1901, C. P. Hill, acting on the advice of W. Blakemore, consummated a deal with a Montreal syndicate closely allied with Canadian Pacific Railway interests and composed of Lord Shaughnessy and associates. Prospecting and development work was done in 1901 and 1902.

Camp.—The camp is situated at an elevation of 6,150 feet on the summit of the ridge between Goat river and Arrow creek. The distance by trail from the railway is about 12 miles. The buildings consist of three cabins, all of which are in a fair state of repair.

Workings.—The most northerly working visited by the writer is on the *American Flag* claim at a short distance from the camp. Here a deep open-cut has been driven across the vein and a 35-foot shaft sunk on the foot-wall side. The shaft was full of water, but it was evident from the dumps that it had been sunk in ore. A sample taken across 10 feet of hæmatite exposed at the top of the shaft assayed as follows: Iron, 55 per cent.; sulphur, trace; phosphorus, *nil;* silica, 6.1 per cent. The ore is a massive black hæmatite which breaks easily under the hammer. The strike of the vein at this point is N. 10° W. and dip 75° to the west, with the slope of the hill, which is about 25°.

The next working is situated at approximately 1,500 feet to the south, on the *O'Ray* claim. At this point another 35-foot shaft has been sunk on ore. At the bottom of the shaft an 18-foot crosscut has been run from wall to wall. Across this width a representative sample was taken, which ran as follows: Iron, 55.2 per cent.; sulphur, *nil;* phosphorus, trace; silica, 7.9 per cent. The wall-rock exposed in either face of the crosscut was decomposed quartzite heavily impregnated with iron. The same dip and strike maintain here as at the *American Flag* shaft. Other work indicates that the ore-body extends for at least 150 feet south of the shaft. Throughout the iron-bearing zone the ore probably occurs in lens-like bodies, and, as the conditions at the

above-mentioned shafts are similar, there is just a possibility that they may both be sunk on the same lens, although there has been no work done to prove the continuity of the ore between them. On the assumption that they are on the same ore-body, a conservative estimate of the possible tonnage would be as follows: 1,500 feet by an average width of 14 feet by a depth of 1,000 feet gives over 2,500,000 tons. Should there be two separate lenses, there would be a possible tonnage of between 800,000 and 1,000,000 tons, providing the ore is continuous to a depth of 1,000 feet.



At a distance of about 2,000 feet in a southerly direction from the *O'Ray* shaft another shaft has been sunk for a distance of 30 feet. It is now filled in, but there is high-grade hæmatite on the dump, the proved width of which is said to have been 9 feet.

The next showing of importance is at the diamond-drill hole on the *Keepsake* claim; this is some 2,000 feet southerly from the last-mentioned showing. At this point the vein has a width of about 50 feet and apparently lies between diabase on the foot-wall and quartzite on the hanging-wall. Its strike and dip are similar to that at the other showings.

The width of the vein across the outcrop is about 50 feet. A deep open-cut has been driven for about 15 feet, exposing in cross-section an 8-foot band of good ore near the hanging-wall; the remaining 42 feet consists of lower-grade siliceous ore. A sample across the 8 feet gave the following returns: Iron, 46 per cent.; sulphur, *nil;* phosphorus, *nil;* silica, 26.5 per cent. This ore is more micaceous than that at the other exposures.

Diamond-drilling was attempted in 1901 with a small gasolene-driven outfit. The hole, which follows the dip of the ore—namely, 70°—is said to have proved ore for 300 feet, but does not give any useful information regarding the width of the ore at this depth. Trenching across the southerly extension of this ore-body has not been adequate, but would indicate the probable continuation of the ore in this direction for at least 200 or 300 feet.

By continuing in a southerly direction along the contact of the dyke-rock and quartzite, numerous other showings may be seen at intervals from the camp to Goat river, some of which indicate the presence of either parallel or nearly parallel veins, accompanied by offshoots from the main igneous mass.

The same character of ore and similar geological conditions are found to prevail at the head of Thompson creek, at a distance of about 4 miles south of the railway, though the continuity of the zone has been interrupted by a big break in the formation, through which Goat river flows in a south-westerly direction.

Conclusions.

The above brief description suffices to show that the hæmatite is distributed over a big area, and that it is invariably associated with the intrusive dyke of diabase, which latter represents an immense mass of igneous rock extending for many miles in a northerly and southerly direction. Such conditions would appear favourable for the deposition of large ore-bodies in certain localities.

The strong showings opened up by surface diggings have not been developed sufficiently to define their boundaries, while the surface has not been thoroughly prospected. For instance, it was only last year that a new discovery was made by George Young, when a 12-foot width of high-grade hæmatite was uncovered on the *Pacific* claim, situated about midway between the camp and Goat river.

The property is conveniently situated to the railway and is within easy reach of the Crowsnest coalfields at Fernie, where a metallurgical coke of high quality can be produced. Water-power for mining purposes could be developed at Goat river.

Should the owners decide upon extensive development, their action would be, in the opinion of the writer, fully justified, the field having undoubted potentialities.

TRAIL CREEK MINING DIVISION.

There has been a considerable increase in production of gold-copper ores from the properties of the Consolidated Mining and Smelting Company at Rossland. The tonnage shipped up to the end of 1921 is 82,093 tons.

The properties owned by this company include the *Centre Star*, *Le Roi*, *War Eagle*, and *White Bear* mines, which are all connected by underground workings and constitute one large mine with a total of about 60 miles of underground workings. The amount of ore extracted from this group since 1894 represents about 5,000,000 tons.

Recent developments have proved good-grade ore on the 1,650-foot *Le Roi* level, which corresponds to the 1,400-foot level of the *Centre Star*. From this ore-body one has to travel for about 1½ miles underground to reach the north-easterly end of the mine-workings.

These facts alone leave room for reflection on the great asset these properties have been to the Province, by the employment of labour and wealth of metals produced.

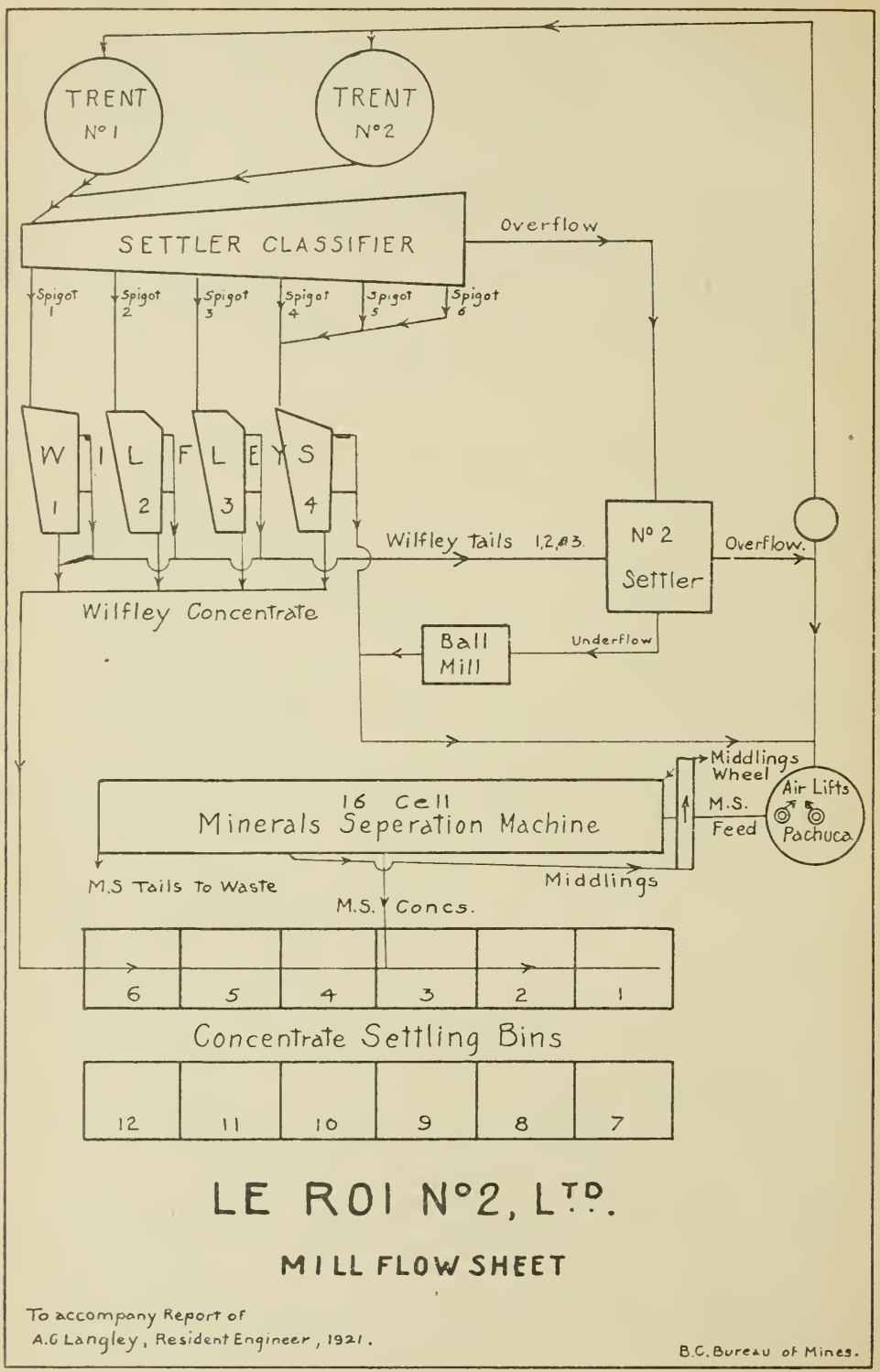
Le Roi No. 2. The production of this property also covers a number of years, dating back to the early nineties. In 1900 the present owning company, the Le Roi No. 2, Limited, was incorporated. Up to 1911 this company paid about $1,500,000 in dividends; later records of results obtained are not available at the time of writing, but no doubt would show considerable profits.

Under the management of D. Lay, the mill has been recently remodelled and a 16-cell, M.S.-type flotation-machine installed. The capacity of the mill is 75 tons a day. Milling operations began in August and over 700 tons of concentrates were shipped to Trail to the end of 1921.

I.X.L. This property was staked in 1891 by Thos. Heady. It is now owned by John S. Baker, of Tacoma, and is being operated under lease by R. B. Shelledy and associates. The claim is situated near the Northport road at a distance of 2½ miles west of Rossland. Old records show that small quantities of high-grade gold ore have been shipped from time to time, the last shipment being made in about 1913.

So far the present lessees have shipped a small tonnage of exceptionally high-grade gold ore. The first shipment of 1,704 lb. returned 183.67 oz. of gold and 29 oz. of silver. The second shipment of 301 lb. of ore returned 140.3 oz. of gold and 23 oz. of silver. These shipments represent values of 215.6 and 932 oz. of gold to the ton of ore, respectively.

Hattie and Richmond. These claims are situated at a distance of 1¼ miles south of Rossland. They are owned by S. Forteath and associates, of Rossland. The country-rock is chiefly composed of a fine-grained monzonite cut by numerous basic dykes. A series of small tightly frozen veins has been exposed by open-cuts and shallow shafts. These veins have an east-and-west strike and dip at about 75°. The continuity of the mineralization is not pronounced, the ore apparently filling cavities at intervals along a fairly persistent strike. Any one of them taken as an individual deposit would not represent an ore-body of any great commercial importance, as far as could be ascertained by the limited



LE ROI N°2, LTD.

MILL FLOW SHEET

To accompany Report of
A.G Langley, Resident Engineer, 1921.

B.C. Bureau of Mines.

amount of work so far done. It is possible that at a depth they may show greater strength or consolidate to form an ore-body of considerable dimensions.

Samples taken across narrow widths from the various showings all gave gold values, of which the following are a few examples: A sample across a pocket of oxidized ore 26 inches wide ran: Gold, 2.01 oz.; silver, 1.7 oz. At a short distance from where this was taken, and on the same vein, a sample across 1 foot at the bottom of a shallow open-cut ran: Gold, 0.33 oz.; silver, 5.3 oz.; copper, 5.02 per cent. A sample taken of decomposed vein-matter from one of the other parallel veins ran: Gold, 1.10 oz.; silver, 2.8 oz. The sulphide ore is a mixture of arsenopyrite, pyrite, and chalcopyrite.

To the south of the *Hattie* are the old workings of the *Lily May*, the first property to be operated in the camp. Here a shaft was sunk 207 feet on a vein having a strike of north-east and occurring in the sedimentary rocks of the Mount Roberts formation. The mineralization is of quite a different character to that at the *Hattie*, the principal values being in silver, with which is associated galena, iron pyrites, zinc-blende, and occasionally stibnite in a quartz gangue. Past records show that only very little ore was won from this vein. The principal development-work has been done at a depth, and as the shaft was full of water these workings could not be examined. After lying idle for a number of years active development was undertaken in 1913 by the Richmond Consolidated Gold Mines, Limited, under the management of J. L. Warner.

The following is an extract from a report by the Gold Commissioner in the Annual Report of the Minister of Mines for 1913: "The *Lily May* was unwatered about September 1st, since when underground work was continuously carried on until December 23rd. Some 600 feet of work was done in exploring the *Lily May* vein and in running north and west drifts. In the west drift a large amount of mineralized ground was encountered, but, while occasional assays gave workable values, the average was below that standard. This drift, now heading north, requires to be driven a considerable distance to reach its objective point—namely, vertically under a surface showing that gives high values in gold and copper-gold from $2 to $140 per ton. . . . A northerly drift started from the bottom of the shaft is in 297 feet, and was driven to cut a series of five veins, all cropping within a width of 250 feet on the *Richmond* and *Hattie* claims. This drift will have to be extended 160 feet to intersect the first of these veins."

From the above it will be seen that the exploratory work being carried on at this property had an important bearing on the *Hattie*, and it is to be regretted that the funds gave out before the northerly tunnel had gained a sufficient length to cut the series of veins referred to.

Velvet-Portland.* This gold-copper property is situated 6½ miles south-west from Rossland, on the north-west slope of Sophie mountain, in the valley of Big Sheep creek opposite Santa Rosa creek, and is connected by wagon-road to the Great Northern Railway siding 9½ miles distant (the Rossland branch of this railway recently ceased operations). A full description of the property and its history, which dates back to 1897, is published on pages 154–158 of Geological Survey, Memoir No. 77, "Geology and Ore-deposits of Rossland" (1915).

In 1918 the Granby Company had a lease and bond on the property, and is said to have pumped out the lower levels and to have done some diamond-drilling below the sixth level, where an important body of sulphide ore was encountered. When, however, this company discontinued mining and smelting operations in the Kootenays, it relinquished its lease of the *Velvet-Portland*, which again relapsed into inactivity.

In 1920 the property was acquired by the Rossland-Velvet Mines, Limited, the promoters of which are practical mining and business men of Rossland (E. Nordman, president; J. W. Gregory, secretary). In that year between 400 and 500 tons of ore was shipped to Trail and Northport smelters. Shipments in 1921 amount to 55 tons shipped to Trail (Northport smelter was closed down early in the year).

The ore shipped by the present owners was extracted from stopes on the upper levels south of the main *Velvet* shaft. This area has proved the most productive in the mine and has been fairly thoroughly exploited. The upper three levels are in a zone of marked oxidation, which appears to extend down in places to the fourth level, where the first sulphide ore was encountered. In the zone of oxidation the principal values are in gold.

The present owners intend to continue shipping ore that may have been overlooked on the upper levels, and to drive a tunnel about 1,000 feet to tap the veins at a depth of approximately

250 feet below the sixth level, and get into the ore that was encountered with the diamond-drill, as well as other ore-bodies that may be found. On completion of this tunnel and shaft connection the mine will be drained to that depth, thus eliminating the heavy expense of pumping the water out, a factor which has prevented the present operators from working on the lower levels.

Hitherto the property has been seriously handicapped by the excessive cost of transportation, including the long haul to the railway. Now, however, the survey for the Trans-Provincial Highway crosses the property. There are about 4½ miles more of this road to be built to reach the *Velvet-Portland*. The completion of this link will enable the owners to ship ore by motor-truck to Rossland; thence by railway to the Trail smelter, thus materially reducing transportation charges. Mining operations also will be greatly facilitated by the opening-up of the road.

Trail Smelter.

The shipping-list for the year shows that ore received for treatment at this plant amounts to approximately 400,000 tons. The bulk of this comes from the company's mines, notably the *Sullivan* at Kimberley. The balance is distributed among sixty-three independent shippers, of which forty-seven are operating in the Eastern Mineral Survey District. The continuous operation of this great metallurgical plant, with a record production of both zinc and lead, has been a bright spot in the history of the metalliferous mining of the district for the year. It is especially remarkable in view of the severe decline in metal prices, which caused stagnation in many of the large mining camps of the United States and the closing-down of numerous metallurgical plants.

This record was achieved by the economic mining of an immense tonnage at the *Sullivan* mine and the successful application of most up-to-date metallurgical practice. A few years ago it would not have been possible, for then the cost of producing 1 lb. of zinc exceeded the present market value of the metal; so, needless to say, great strides have been made in the recovery and separation of lead and zinc from the complex ores of the *Sullivan* mine. In this connection selective flotation has been a very important factor. The result of the season's work cannot help but reflect credit on the management, for such an achievement means good organization and general efficiency of the staff.

In September the Consolidated Mining and Smelting Company issued an amendment to its schedule of smelting rates, the essence of which is as follows: Under the existing Schedule C the quantity of silver and lead to be paid for was diminished by a sliding scale for ores carrying 10 per cent. zinc and over. This has been abolished. The amount of exchange allowed for the net value of gold and silver paid for will be that in excess of 3 per cent. instead of 5 per cent. as previously. The price for lead to be used in settlement will be the London Metal Exchange spot quotation for soft Spanish lead. The treatment rates as in Schedule C are unchanged, except the charge for zinc will be 50 cents per unit instead of 60 cents. Payment in full will be made in ninety days after date of arrival. Drafts will be accepted for all or part of the value, which doubtless could be negotiated without trouble at any bank. Interest during this period will be borne by the shipper.

The circular issued by the company goes on to say: "The price of lead is low on account of the large quantities in keen competition in the Orient. The Canadian market is taking only a small quantity. The intention is to vary the lead payment from time to time to suit conditions. Stocks are very large at present, which, added to the poor market conditions, makes it necessary to defer payments. We hope to be able to reduce the time of payments as conditions become better."

Since this circular was issued the company has notified the shippers that owing to the satisfactory reduction of surplus stock, beginning with January 1st, 1922, it will make payments as soon as possible after sampling; in other words, pay spot cash.

REVELSTOKE, TROUT LAKE, LARDEAU, AND ARROW LAKE MINING DIVISIONS.

Generally speaking, mining activities in these Divisions have been principally confined to leasing and prospecting, no operations on a large scale having been carried on. During the summer months things were unusually quiet, but latterly there seems to be a more optimistic feeling prevailing in the different mining centres, which would indicate that we can look for an improvement in conditions next year.

REVELSTOKE MINING DIVISION.

The activities during the season may be summarized as follows: A few men were employed at the *Lanark* mine during the summer months. At the *Waverly-Tangier* group several men

were employed at the mine and a crew of nine men on road-repair work. D. Woolsey did some prospecting on a deposit of amphibole asbestos near the main line of the C.P.R. in the vicinity of Illecillewaet. In the Big Bend district lode mining and prospecting generally has been inactive, although gold placer mining has been continued in the neighbourhood of Goldstream and French creeks by Alec. McRae, Remillard, J. C. Montgomery, and a few other old timers. Gus Lund and his partner spent part of the season prospecting their claims near Goldstream.

Big Bend District.

This area lies immediately north of Revelstoke and is bounded, as the name implies, by the Big Bend of the Columbia river. A trip was made into this country during the early part of September, but unusually wet and stormy weather greatly interfered with prearranged plans and limited the amount of useful work that could otherwise have been accomplished. The early history of the district relates that placer-mining was actively carried on in the sixties, when many of the tributary creeks of the Columbia river were prospected and some of the river-benches worked. In these times a thriving mining camp existed at Goldstream, steamboats plied up the river as far as the mouth of Downie creek, and never a day passed during the season that there was not a long pack-train on the trail taking in supplies from Revelstoke.

Now there is little to remind one of these good old days, as nearly all the old landmarks have become entirely obliterated, and if it were not for a handful of old-timers who persistently work at their diggings year after year the existence of gold placer deposits of the upper Columbia river would soon be forgotten.

It was many years after the first placer excitement died down that the attention of mining men turned to the possibilities of lode-mining, and a number of claims were staked at no great distance back from the Columbia. Silver-lead and copper deposits were discovered, demonstrating that there was a mineralized zone at a distance of from 6 to 10 miles back, while beyond this there still remains an immense area yet to be explored.

Transportation.—One often hears the question, "If ore is developed in this country, how can you get it out?" While admitting that transportation facilities are not all that could be desired, there are two features worthy of mention. One is that the Columbia river is easily navigable from the mouth of Downie creek to 19-Mile, at which latter point connection can be made with a wagon-road to Revelstoke, and the other is that the lateral valley of Downie creek affords a low-grade pass penetrating far into the heart of the Big Bend area, thus offering transportation possibilities for any properties located in the vast country surrounding this creek and its branches.

Topographical Features.—The area contains some very rugged and difficult country, typical of the northern section of the Selkirk mountain system. The creek-valleys and lower hillsides are heavily timbered with cedar, spruce, balsam, and hemlock, while ferns and devil's-club grow in almost tropical profusion in the low-lying swampy places. The valley of the Columbia between Revelstoke and Downie creek is narrow. The hill-slopes to the east are uniform and rise almost from the banks of the river, except in a few spots where there are low-lying bench lands of limited area. In such places farming has been attempted in the past, but owing to difficulties of marketing the produce these cultivated areas, with few exceptions, have been abandoned.

A panoramic view of the summits from near Downie creek presents a sea of high peaks and ridges dotted here and there with white patches of snow and ice, in contrast to which the occasional grass-covered slopes of the glacial basins stand out in pleasant relief.

Geology.—As the trail leads through evergreen forests for most of the way, only glimpses here and there could be obtained of the rock formations, and it is not until the summits are reached that an idea of the outstanding geological features can be formed.

The impressions gained were as follows: From Revelstoke to LaForme creek, the formation principally consists of granite cut by pegmatite dykes; in places there are large inclusions of schistose rocks. Beyond this, as far as Downie creek, greenish-grey schists, having a north-west strike, with thinly bedded bands of crystalline limestone, predominate. This series has been invaded by both basic and aplitic dykes, the latter variety predominating, originating from the near-by batholith.

A number of claims staked many years ago in this schist-belt have had varying amounts of development-work done on them, but there are no records of any ore having been shipped and they are all now lying dormant. They include the *Mastodon* group, a silver-lead-zinc property near the head of LaForme creek; the *J.L.* group, on Carnes creek, a silver-lead-zinc property;

the *Roseberry* on Carnes creek, a gold property; the *Standard* group at the head of 5-Mile creek, a copper property; the *Montgomery* group on Downie creek, a copper property; and others.

Type of Deposits.—The ore-deposits in this schist-belt occur as replacement deposits along sheared zones and represent mineralized bands conforming to the dip and strike of the formation.

From experience in the field and from personal observations, the writer would consider that this belt offers better possibilities for gold and copper deposits than it does for silver lead. The largest silver-lead deposits in the West Kootenay are invariably associated with carbonaceous slates and limestones. In the Big Bend district the northerly extension of these rocks probably continues farther back from the river, but the country, being an extremely difficult one to prospect, has been neglected.

Montgomery Group.

This property, comprising a group of ten claims, is situated at the head of Canyon creek, which flows into Downie creek at a point 9 miles from its confluence with the Columbia river. In a direct line it is about 2 miles or less from Downie creek and about 4 miles by trail. The distance from Revelstoke is about 55 miles.

Topography.—The claims are located on a steep and narrow ridge of Downie mountain, on either side of which deep canyons have been cut by glacier-fed creeks. The country is rugged in the extreme; the steep slopes are scored and laid bare in many places by the action of snowslides. The elevation at the point where the mine trail leaves Downie Creek valley is 2,000 feet, and that at the end of this trail, where most of the work has been done, is 5,500 feet.

Geology.—The geology of this area is particularly interesting, for erosion has revealed an almost vertical section of formation for nearly 3,000 feet. From this it can be seen that the base of Downie mountain is composed of a large mass of granite, overlying which there is a series of highly metamorphosed rocks consisting of dark schists. Near the summit the rocks are of lighter colour, probably consisting of greenish-grey schists: in these there are several bands of limestone which form a distinct geological horizon. Near the granite-contact the metamorphism is more pronounced and the formation, which is contorted and foliated, has been invaded by numerous aplitic dykes. The general tendency of these has been to conform with the schistosity of the rocks, and as they form narrow bands of highly siliceous material, they might easily be mistaken by the inexperienced prospector for quartzite or even quartz veins. The schists and limestone represent a thickness of from 300 to 500 feet, striking to the north-west and dipping to the north-east with marked regularity.

Ore Occurrences.—The ore occurs in mineralized bands, conforming to the dip and strike of the formation, possibly along the contact of a thin band of limestone and schist; the former having been replaced by mineral-bearing solutions. Although these bands exhibit continuity, the ore occurs in lenses where structural conditions have been favourable for deposition.

There are said to be five veins exposed between Canyon creek and the summit of the ridge some 3,000 feet above, along which there are exceptionally strong showings in bluffs and precipitous canyons swept by snowslides. Unfortunately weather conditions precluded an examination being made at higher altitudes. Such exposures only serve to show the extent and character of the mineralization, but as individual deposits they might as well be non-existent, owing to adverse climatic conditions and inaccessibility.

Workings.—The principal working is situated at the end of the trail at an elevation of about 5,500 feet. It consists of an open-cut about 100 feet long, exposing a width of 10 feet of ore along the dip of the vein, which strikes N. 55° W. and dips at an angle of 25° to the north-east.

The whole face is heavily stained with iron oxide. Upon breaking off samples at random, visual inspection showed that the bulk of the vein-matter consisted of massive pyrrhotite slightly discoloured in patches with chalcopyrite. In a few places where transverse shearing had produced fractures there has been a concentration of chalcopyrite associated with a quartz gangue. A sample of chippings taken at random along the face of the open-cut gave the following returns: Gold, trace; silver, 0.6 oz.; copper, 4 per cent. The bulk of the ore is so massive and hard that it is practically impossible to break off a representative sample with a moyle and prospecting-pick; hence the only satisfactory method would be to blast off large samples and quarter them down.

Another working about 300 feet higher up the hill on the same vein shows a width of about 15 feet for a length of 50 feet. Here the ore is more broken and mixed with country-rock. In

the opinion of the writer, a representative sample would not carry more than 2 per cent. copper. The above work was done by the Granby Consolidated Mining and Smelting Company in 1917.

In conclusion, the surface showings are strong, the copper tenor of the ore is low, and whether a sufficient tonnage exists to constitute an ore-body of commercial importance yet remains to be proved by further work.

On the return journey from the above-mentioned property, an early start was made from McIntosh's cabin for Keystone mountain by taking the old trail which leaves the Big Bend trail at a point 40 miles from Revelstoke. The summit was reached after four hours' steady climbing and camp was made for the night in an old dilapidated cabin on the *Carbonate Chief* claim. On this property a good deal of prospecting-work had been done many years ago in an endeavour to exploit a few quartz-croppings, but nothing of importance had been disclosed. A sample of some of the most likely-looking quartz ran: Gold, trace; silver, 1.4 oz. The elevation at the cabin is 6,400 feet.

The next morning the weather was very cold and uncertain, so instead of examining the various claims on the northerly end of Keystone mountain, as was intended, it was decided to make for the *Standard* mine before a possible snowfall might prevent the trip. After travelling from early morning over the beautiful park-like country of the summits, the *Standard* was reached shortly before dark. The rounded summits and ridges, together with the broken and crushed schists underlying the surface soil, give ample evidence that this picturesque summit was at one time the resting-place of an immense glacier.

Standard Group.

This property, comprising ten Crown-granted claims and eight fractions, is located at a distance of about 15 miles by trail from the Columbia river and thence about 35 miles to Revelstoke. The camp buildings, situated at an elevation of 6,500 feet, consist of two cabins. The accommodation at one time was sufficient for ten or twelve men, but the buildings are now in a state of dilapidation. The camp-site is nearly a mile from the workings. The property was extensively developed some fifteen or twenty years ago, since which time it has been abandoned, and in 1917 was sold for taxes to R. Abernethy, of Marpole, B.C., who is the present owner.

The principal workings are situated on the easterly slope of a narrow ridge which forms the divide between two small branches of the South fork of Downie creek. On the westerly side of this ridge the strata, dipping at an angle of 25° to the north-east and striking to the north-west, are freely exposed in a series of rugged bluffs. On the easterly side of the ridge glacial action has scooped out an extensive basin-like depression, leaving a fairly gradual slope to a point some 500 feet below the summit. Along and near the summit of this ridge there are indications of mineralization and a number of pits and open-cuts show that early prospecting had been quite extensive.

The formation consists principally of greenish-grey schists, with occasional thin beds of highly metamorphosed limestone. In the vicinity of the workings the following order of stratification was noted: Greenish-grey schists, a thin bed of limestone overlying a black schist, which latter had been subjected to much movement, as evidenced by numerous slickensided surfaces. The ore, consisting principally of chalcopyrite, was evidently deposited along the contact of these black schists with the limestone. The limestone has been eroded away and the workings are in the black schists, in which the ore was found to occur in lenses within the foliations of the schist. It also probably replaced the limestone along the contact.

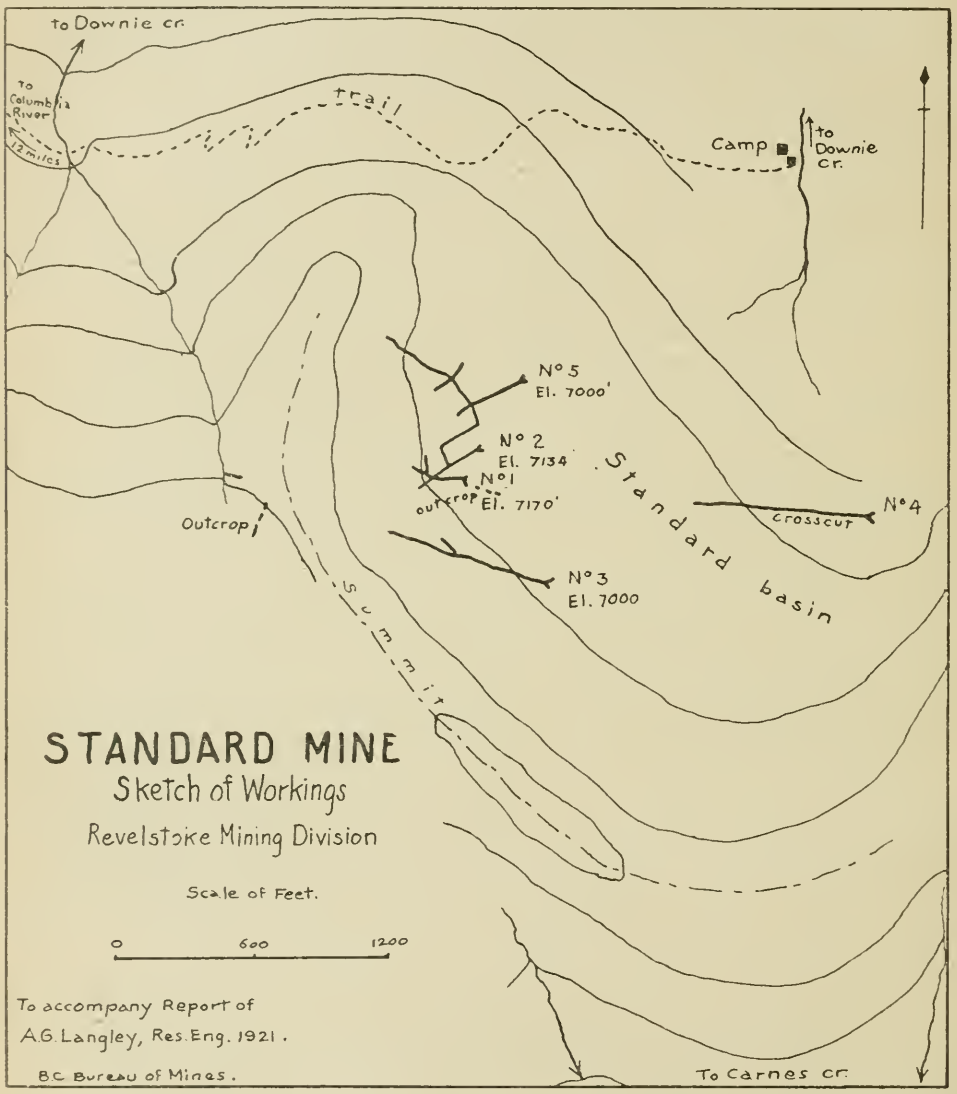
The ore-zone as developed constitutes a mineralized band conforming to the dip and strike of the formation and has been approached by three crosscut tunnels, which develop the vein to a vertical depth of 170 feet below the uppermost underground working. Unfortunately the various underground workings could not be examined, as they were either caved or full of ice and water.

A careful inspection of the dumps showed them to consist principally of crushed and slickensided black schists. No ore of any appreciable amount was noticed. According to a reliable assay plan in possession of the writer, the average values ran between 3 and 4 per cent. copper, with negligible values in gold and silver. Two other long crosscuts which had been driven were poorly located and did not develop ore.

It is roughly estimated by the amount of work done that the total expenditure on this property must have been at least $50,000 or $60,000. No doubt a lot of the money was thrown

away through lack of good judgment in planning the development-work. For further reference *see* the Minister of Mines' report for 1905.

One of the most interesting geological features of this area was the presence of a large mass of serpentine, which outcropped near the easterly side of the basin. Upon investigation it was found to contain numerous stringers of chrysotile asbestos of inferior grade, but which might improve in quality at depth.



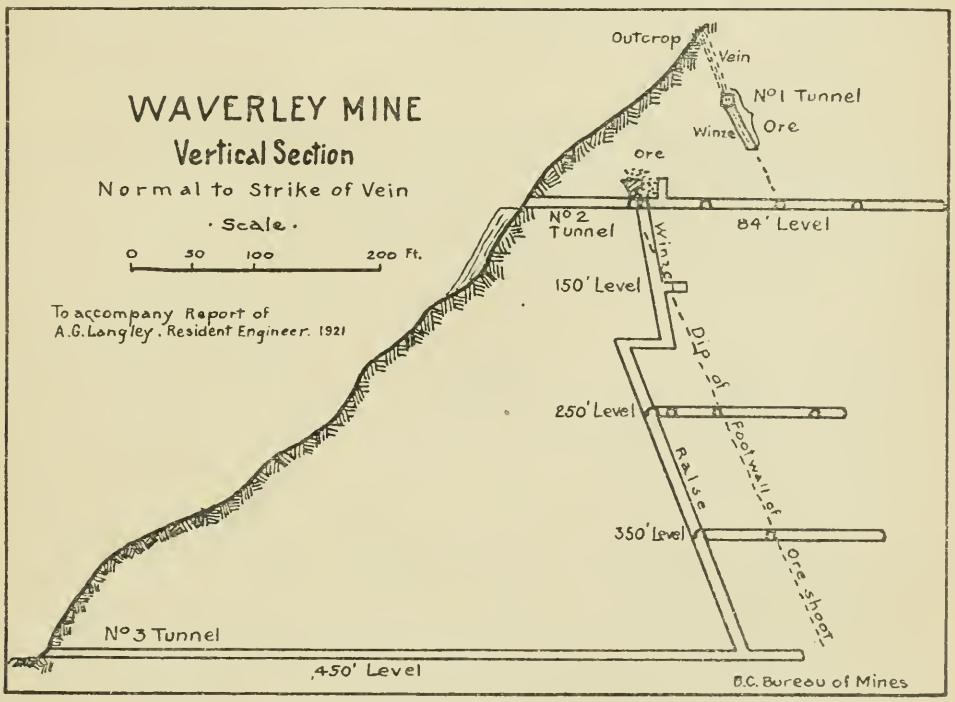
Waverly-Tangier Group.*

This property, situated at the head of the North fork of Downie creek, about 1½ miles below the summit flats separating that creek from the North fork of the Illecillewaet river, was acquired in 1918 by the Waverly Mines Company, of Spokane (F. M. Martin, president; G. H. Walters, secretary). Although the property is tributary to Downie creek, which flows into the Columbia river 46 miles above Revelstoke, the present route is by an old wagon-road about 28 miles in length (estimated), following the North fork of the Illecillewaet river from Albert Canyon, on the main line of the Canadian Pacific Railway 21 miles east of Revelstoke.

The old underground workings, which are quite extensive, date back to 1897 and 1898, when the property was being operated by the Gold Fields of British Columbia, an English company. The mines were closed down in 1899 and were idle until 1918, when the present company took them over. Since then a small crew varying from two to six men has been engaged on development during the summer months, putting in an occasional winter. Work done from 1918 to 1921 includes some 200 feet of tunnelling. The property comprises two separate groups, the *Waverly* and *Tangier*, of which the former is the most important.

The formation of the area consists of conformable beds of siliceous and argillaceous limestones, slates, quartzites, and schists, which have a north-west and south-east strike, dipping to the north-east. Both the *Waverly* and *Tangier* deposits occur in limestone.

Waverly.* This group consists of the *Waverly* and *Montague* (both Crown-granted), *Summit Lode*, *Mountain Goat*, *Montague Fraction*, and *Waverly Fraction* claims, which extend along and cover the steep mountain-side on the northern side of the creek from an elevation of 5,600 to 7,200 feet above sea-level. The vein, which conforms to the bedding of the country-rock, can be traced by open-cuts and stripping for over 2,000 feet along the outcrop, showing marked persistence in strike and dip (strike N. 40° W.; dip 60° to 65° to N. 50° E.). The width of the vein on the surface varies from 18 inches to 4 feet.



The ore is chiefly carbonates with small amounts of galena, the gangue consisting of altered country-rock, decomposed calcite, and quartz. The average silver content of the ore indicated by the few samples taken by the writer would appear to lie between 30 and 50 oz. to the ton, the lead content varying from a trace to 18 per cent. The gold values, generally speaking, appear to be negligible. Some of the ore shows copper-stains, indicating a small percentage of the metal. There is undoubtedly a very considerable tonnage of oxidized silver-lead ore available.

The underground workings, which in the aggregate will amount to about 3,000 lineal feet, mostly crosscut and develop one big ore-shoot. In the case of this shoot, which lies on the foot-wall side of the vein, replacement of the limestone walls has occurred on an extensive scale.

The examination was necessarily confined to the surface showings, No. 1 and No. 2 tunnels, as the workings below No. 2 tunnel were inaccessible owing to a cave near the portal of No. 3 tunnel and the bad condition of the timbers in the winze below No. 2 tunnel (the lower workings have since been made accessible). Practically all the development was done on the *Waverly* and *Montague* claims, principally on the former.

Commencing at the surface and proceeding downwards, the workings are briefly as follows:—

On the *Montague* claim, at an elevation of about 6,200 feet, a short crosscut encountered the vein at a distance of 20 feet and a winze was sunk 17 feet on carbonates containing streaks of galena. A sample across 4 feet near the bottom of the winze gave: Gold, 0.04 oz.; silver, 8 oz.; lead, 11 per cent. About 350 feet south-easterly along the outcrop a sample across 18 inches in a shallow cut gave: Gold, 0.02 oz.; silver, 14.4 oz.; lead, 14.9 per cent.

On the *Waverly* claim, about 750 feet south-easterly from the above crosscut and at about the same elevation, No. 1 tunnel was driven 90 feet on the vein just below its apex. In this tunnel the width of the vein varies from 14 inches to 2 feet. Near the portal of the tunnel a winze was sunk on the vein to a depth of 45 feet, the lower portion of which was caved and inaccessible. A sample across 2 feet at the top of the winze gave: Gold, 0.06 oz.; silver, 39.02 oz.; lead, 17 per cent.

About 300 feet south-easterly from and 84 feet vertically below No. 1 tunnel, No. 2 tunnel is a crosscut 330 feet in length. At 85 feet in from the portal the foot-wall of the ore-body was reached and drifted on for 85 feet north-westerly and 50 feet south-easterly. The 85-foot drift breaks through to the surface. Above the intersection of the crosscut and the two drifts a small stope was started. A sample across a width of 10 feet in the stope gave: Gold, 0.24 oz.; silver, 77.2 oz.; lead, 18 per cent.

The crosscut, passing through the ore-body, was then continued 245 feet farther. As the ore passes by insensible gradations into barren limestone, the width of what may constitute "ore" can only be determined by extensive sampling, having in view the grade of material which can be economically milled. The total width of the mineralized zone cut by the main tunnel is approximately 66 feet, including a horse of barren limestone of undetermined width, but which for sampling purposes was assumed to be 16 feet wide. The mineralization is strongest on the foot-wall side of the zone, as shown by the above-mentioned sample taken in the stope.

Samples along the crosscut gave as follows: Across 34 feet, including the good ore on the foot-wall side: Gold, 0.02 oz.; silver, 16 oz.; lead, 2.5 per cent. The 16-foot limestone horse was then omitted and a sample across 16 feet on the hanging-wall side of the zone gave: Gold, trace; silver, 2.4 oz.; lead, 0.2 per cent. Little importance can be attached to these results, however, mill tests being required to give reliable information on the values to be expected.

The hanging-wall of the ore-zone, which is marked by a seam of calcite, was drifted on south-easterly for a distance of about 70 feet. The hanging-wall seam was not drifted on in the opposite direction, but a little farther along the crosscut a semicircular tunnel driven north-westerly is in country-rock for the most part, but breaks into the hanging-wall of the ore-zone near the face. As a short crosscut tunnel had been run off the drift at this point, it was possible to get a sample across a 16-foot section, which gave: Gold, trace; silver, 2.8 oz.; lead, 1 per cent.

Farther along the main crosscut another tunnel, driven 60 feet north-westerly along a seam of calcite, is in country-rock. Several short tunnels and a 26-foot raise off the main crosscut in the ore-zone show strong mineralization, a grab sample from several hundred tons of material stored in these places giving: Gold, 0.14 oz.; silver, 36.8 oz.; lead, 15.5 per cent.

On the first south-easterly drift above mentioned, which follows the foot-wall of the ore-body, a winze was sunk 110 feet, at which point an offset was made to connect with a raise 260 feet up from No. 3 tunnel.

The vertical depth between No. 2 and No. 3 tunnels is 350 feet, and three intermediate levels have been turned off from the big winze and raise, named the 150-foot, 250-foot, and 350-foot levels, which means that they are respectively that distance vertically below No. 1 tunnel. As, for reasons stated above, all the workings below No. 2 tunnel were inaccessible, the information relating to them has been taken from the old company's maps and records, which show that the ore-body was encountered and developed on all three intermediate levels, with good results as to width, length, and values.

No. 3 tunnel, 450 feet vertically below No. 1 tunnel, is a crosscut about 635 feet long (by scale), which apparently was discontinued a short distance from the expected intersection with the vein.

Tangier.* This group consists of the *Tangier* (Crown-granted), *Tiger*, *Silver Tip*, and *Black Bear* claims, which are located along the bank of the creek immediately below and south of the *Waverly* group, at an elevation of 4,800 feet (collar of shaft). Outcropping along the creek-bed there is a well-defined fissure-vein with a similar strike and dip to the *Waverly* vein, also conforming to the bedding of the country-rock, which can be traced by open-cuts and stripping for over 1,000 feet along the surface. This vein, which varies in width from 1½ to 5 feet, contains in places small bunches and stringers of galena and zinc-blende, with streaks of grey-copper. The gangue is quartz, calcite, and limestone. The shaft was sunk on an ore-shoot lying on the foot-wall side of the vein at some little distance from it. The vein itself does not seem to have been reached by the underground workings.

The development on the *Tangier* consists of 110 feet of double-compartment shaft, 829 feet of tunnelling, and a 100-foot winze. The shaft is situated on the *Tangier* claim a short distance south-easterly from and a little above the creek. The ore developed in the workings is of the replacement type, probably connected with the above-described vein.

The ore piled on the dump, amounting to several hundred tons, consists of galena, zinc-blende, pyrite, with small amounts of grey-copper in a gangue of quartz, calcite, and limestone. A grab sample from this large pile of ore gave: Gold, 0.06 oz.; silver, 16 oz.; lead, 8.5 per cent.; zinc, 5 per cent. A picked specimen of pyrite and quartz from the same pile gave: Gold, 5.6 oz.; silver, 8.2 oz.

The *Tangier* ore differs from that of the *Waverly*, in that there is generally less evidence of oxidation, and the *Tangier* ore contains appreciable gold values in association with pyrite. There is a separate pile (roughly estimated at 200 tons) near the shaft-dump of black decomposed ore which apparently came from the winze below the 100-foot level. A grab sample of this material gave: Gold, 0.24 oz.; silver, 21.2 oz.; lead, 8.5 per cent.; zinc, 15 per cent. The workings are briefly as follows: A vertical double-compartment shaft was sunk for a depth of 100 feet. A small surface tunnel north of the shaft was run in and encountered ore, connection being made with the shaft at the 20-foot level. Records show a small stope was started from this 20-foot level and continued to the surface, the ore being stored in a pile below the shaft-dump. At the time of the examination the shaft connection was full of ice and the portal of the adit was caved, so this level could not be inspected.

At the 100-foot level drifts were run north-westerly and south-easterly, encountering two mineralized zones, one on each side of the shaft. The ore-shoot in the south-east drift, having the strongest showing, was prospected by a 100-foot vertical winze. At the time of the examination this was partly filled with water. A grab sample from a small pile of black decomposed material around the collar of the winze gave: Gold, 0.16 oz.; silver, 35.6 oz.; lead, 11 per cent.; zinc, 3 per cent.

This ore-shoot in the south-east drift on the 100-foot level has an apparent length of 40 feet and a width of from 4 to 6 feet. A sample across 6 feet in the face of the drift gave: Gold, 0.1 oz.; silver, 3.7 oz.; lead, trace; zinc, 1 per cent.

The ore-shoot in the north-westerly drift shows little mineralization, a sample across 4 feet giving: Gold, trace; silver, 0.8 oz.; lead, *nil;* zinc, 2.5 per cent.

In addition to the above workings, several hundred feet of tunnels have been run in barren limestone, in which there are numerous open fissures and calcite-seams.

At present transportation to the *Waverly-Tangier* property offers a serious problem, as the old wagon-road, long disused, is in such a bad state that practically a new road would have to be constructed throughout. The problem of deciding on a route to the property will require very careful consideration.

Asbestos.—Inquiries made last year for asbestos by Japanese representatives aroused interest among the prospectors and samples were brought in from far and wide. With the exception of some chrysotile, they were all of the amphibole variety, which has no commercial value.

The chrysotile asbestos was discovered many years ago by R. Armstrong on the westerly slope of Mount Sproat, near Arrowhead. It did not, however, attract much attention, for it was thought to be of inferior grade and very little prospecting-work was attempted.

This year J. T. Lauthers joined forces with R. Armstrong, and further prospecting was done, with encouraging results, although the work accomplished was very limited owing to lack of capital. The following is a brief description of the property:—

Asbestos Group. This group comprises four claims and is situated at a distance of 3 miles from the town of Arrowhead, in the Lardeau Mining Division. It is owned by J. T. Lauthers, of Revelstoke, and R. Armstrong, of Sidmouth. In a direct line the claims are within 2 miles of the branch line of the Canadian Pacific Railway running between Revelstoke and Arrowhead. The elevation of the deposit is 4,200 feet above sea-level, or 2,800 feet above the Canadian Pacific Railway track.

At this altitude there is a belt of serpentine rocks, which are described by M. F. Bancroft, of the Geological Survey, as follows: "The serpentine has been formed through the alteration of a basic igneous rock, intruded as a dyke or stock into a sedimentary series of quartzites, crystalline limestones, and metargillites. The serpentine-belt, crossing the hillside, attains a width of about 1,000 feet and forms bluffs for half a mile or more paralleling the Columbia river."

The surface of the hillside is mostly covered with overburden and has only been prospected by a few pits and open-cuts over a small area, but wherever work has been done it has exposed asbestos-bearing serpentine. The asbestos occurs filling small veinlets in the serpentine as cross-fibre, with widths varying from ⅛ to ¾ inches. It also occurs as "slip-fibre," having a length of 3 inches.

The short-fibre asbestos is harsh and brittle and lacks the tensile strength necessary for spinning purposes; it should, however, make a good filler for textiles. In the opinion of Dr. R. A. A. Johnston, of the Geological Survey, it is as good if not superior to much of the South African stock which is coming on to the market in apparently increasing amounts to be used as a filler. The best grade so far found is pronounced to be worth possibly about $400 per ton.

As already stated, very little work has been done; the results obtained so far are encouraging, but more capital will have to be expended on further development in order to determine the extent and prevailing quality of the asbestos.

Wigwam Group.* An examination of this property was made following an application for assistance towards the cost of making repairs to the trail leading to it.

The group, consisting of the *Wigwam No. 1*, *No. 2*, *No. 3*, and *No. 4* claims, owned by R. Armstrong and J. Kirkpatrick, of Arrowhead, is situated on the northern side of Isaac creek, about 7 miles by trail and road from Wigwam, on the Canadian Pacific Railway south of Revelstoke.

The old workings are about 1,000 feet (estimated) above the creek. The ore is low-grade lead-zinc, occurring as a replacement deposit in limestone. The associated minerals are galena, zinc-blende, pyrite, and pyrrhotite in a limestone gangue.

The ledge, which dips flatly into the mountain in conformation with the enclosing strata, appears to be from 50 to 60 feet in width. Outcroppings of ore can be found at intervals for several thousand feet along the strike on the surface. Between the outcroppings of ore the soil is discoloured and reddish from the oxidation of the sulphides.

The old workings consist of some open-cuts across the width of the ledge. Grab samples of broken ore in three of these open-cuts assayed as follows: Gold, *nil*, trace, trace; silver, *nil*, trace, trace; lead, trace, 11 per cent., 8 per cent.; zinc, 3 per cent., 11 per cent., 5 per cent. These results were disappointing, as former assays are said to have given as high as 10 oz. of silver to the ton.

Although the deposit has hardly been scratched as yet, it is obviously very extensive. If a demand for this type of ore should develop, and if a tonange of ore sufficient to warrant the erection of a concentrator should be blocked out, a good site for a concentrator could be obtained on the creek below the claims. Timber for mining purposes is plentiful.

Trout Lake Mining Division.

The following is a brief summary of the activities in this Division:—

At the *True Fissure* a crew of about five men will be employed during the winter at extending the lower or C tunnel some 300 or 400 feet.

Recent work by Andy Craig and Alex. McLean at the *Noble Five*, situated at the head of Brown creek, uncovered a nice showing of ore 18 inches wide in the bottom of the upper tunnel. A sample taken across 2 feet of vein-matter ran: Gold, 0.40 oz.; silver, 75.6 oz.; lead, 16 per cent.; zinc, 24 per cent.

M. Leahy, who has been in charge of the development-work at the *Crescent* and *Horn Lead* properties, reports that satisfactory results have been obtained.

S. Faulk and S. White, who have been leasing at the *Nettie L.* shipped 18 tons of silver-lead ore to Trail.

At the *Silver Cup* S. Cavanaugh was working under a lease during the season. A small shoot of ore was encountered not far from the portal of the 700-foot level, from which he expected to make a shipment of 15 or 20 tons. A grab sample from a small pile of sorted ore ran as follows: Gold, 0.16 oz.; silver, 146.4 oz. to the ton; lead, 54 per cent.; zinc, 1.6 per cent. The property was visited by the writer, but in view of the condition of the workings, the limited amount of time at his disposal, and the lack of facilities in the nature of mine-maps and records of shipments made, no report will be attempted on this occasion; more especially as the property has already been reported on, which reports may be seen in the Annual Reports of the Minister of Mines for 1914, 1903, and 1904. From these reports it will be seen that the mill erected to treat the ore was unsuitable. In this connection it must be remembered that it was designed and installed before the oil-flotation process had been successfully introduced as an economical method for the separation and recovery of metals.

J. W. Livingston continued development-work at the *Gold Bug*, on the South fork of Lardeau creek, and had a small tonnage of clean galena ready for shipment.

At the *Parsboro*, which is situated across the creek from the last-mentioned property, a tunnel 180 feet in length has been driven to gain depth on a showing of ore in an old shaft. Work was discontinued before the tunnel had gained its objective.

Mrs. Jowett, as usual, spent part of the summer prospecting at the *Foggy Day* and at other properties in which she is interested along the summit of Silver Cup mountain. At this property good gold values are obtainable; for instance, a sample of earthy oxidized material from an open-cut ran: Gold, 7.54 oz.; silver, 43.2 oz. to the ton.

J. H. Martin and associates purchased the *I.X.L.* and *J.I.C.* claims on Triune creek from C. T. Porter. Four or five men were employed during the season. The work consisted of driving a 100-foot tunnel, building a new cabin, and improving the trail. It is reported that there is a good showing of galena in the tunnel and that work will be resumed next spring.

Dan Savoy, an old-time placer-miner of the Trout Lake district, after some twenty-five years spent in the Klondike and Alaska, has returned to make tests of the gravels along Lardeau creek from the lake, with a view to forming a company to carry on placer-mining on a larger scale.

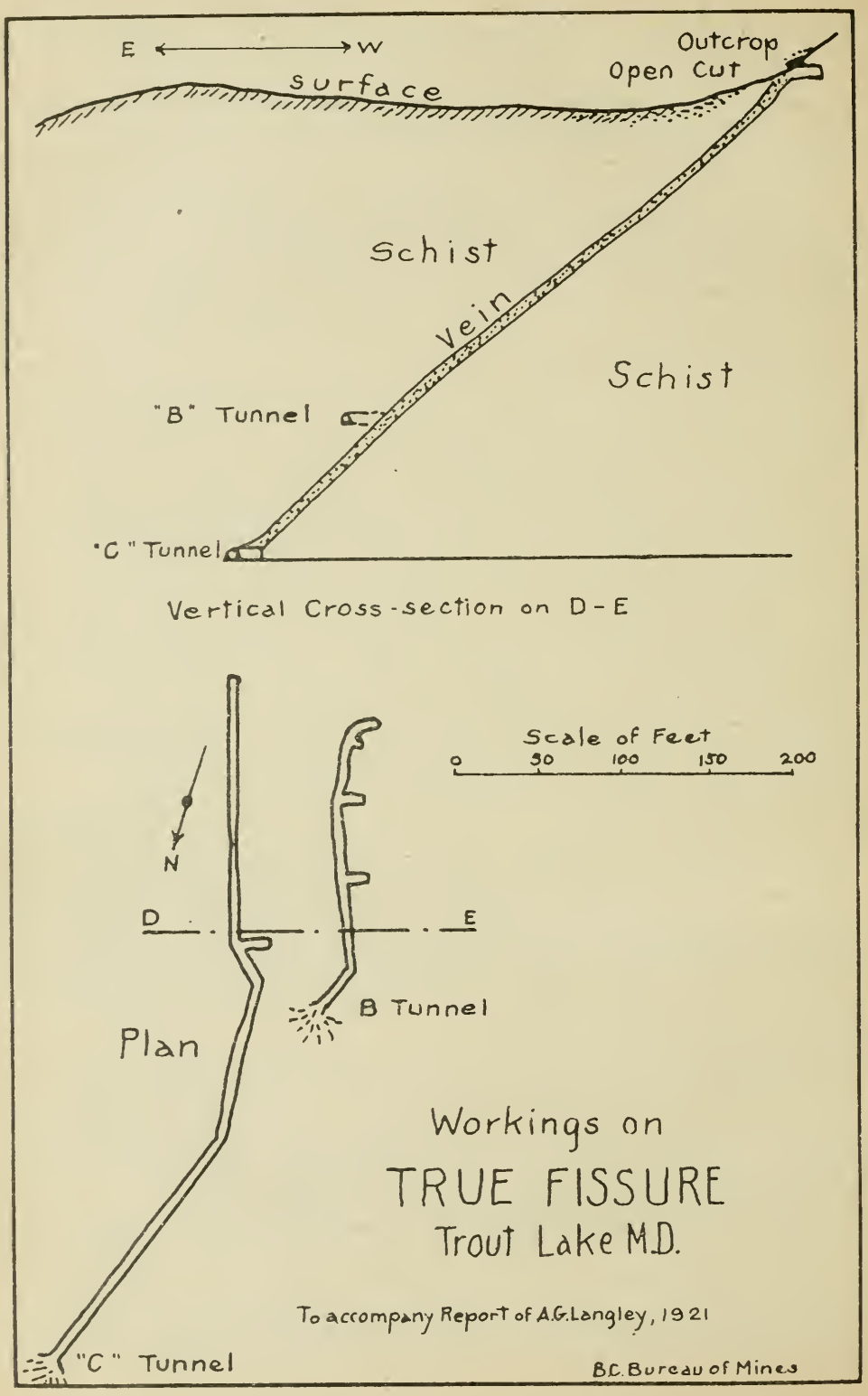
True Fissure.

This group, comprising eight Crown-granted claims and fractions, is owned by the True Fissure Mining and Milling Company, of Cincinnati, Ohio, of which Theo. W. Mitchell is secretary. The property is situated on the Great Northern mountain at a distance of about 3 miles from Ferguson, from where a good trail leads to the camp. The elevation of the workings ranges from 5,500 to 5,700 feet above sea-level. The topographical features in the vicinity of the workings afford a good camp-site, and it is a property that can be worked the year round without any danger or inconvenience from snowslides, which often accompanies operations at these altitudes.

The prospectors who discovered this property must have at first thought that they had one of the greatest bonanzas in the country, for erosion has cleaned off the hanging-wall of the vein, leaving highly mineralized material as a coating on the foot-wall, thus exposing a large area devoid of vegetation or any other covering. The vein is a strong quartz-filled fissure dipping at about 40° to the east and striking N. 20° W., it conforms to the stratification of the country-rock. The foot-wall is composed of light-coloured highly siliceous schist.

It was difficult to determine the exact nature of the hanging-wall on account of its highly altered state, but the impression was gained that it consisted of a siliceous lime-schist. In any event it would appear that the vein occupies a sheared zone which has been produced by movement along the bedding-planes. On the hillside above the large surface exposure no evidence of its continuation could be seen.

Numerous open-cuts and small workings have traced the continuity of mineralization for a horizontal distance of 1,500 feet or more, but the main concentration of ore seemed to have been


E
W
surface
Outcrop
Open Cut
Schist
Vein
Schist
"B" Tunnel
"C" Tunnel
Vertical Cross-section on D-E
Scale of Feet
0 50 100 150 200
N
D
E
B Tunnel
Plan
Workings on
TRUE FISSURE
Trout Lake M.D.
To accompany Report of A.G. Langley, 1921
"C" Tunnel
B.C. Bureau of Mines

centralized around the large surface exposure and at the *Blue Bell* workings, which lie some 800 feet to the north.

The predominant ore exposed at and in the vicinity of the outcrop, and of which there is a considerable tonnage, was a fine-grained mixture of galena, zinc-blende, and iron pyrites. A sample of this ran: Gold, 0.06 oz.; silver, 18.5 oz.; lead, 27.2 per cent.; zinc, 30.7 per cent.

The principal underground workings consist of two tunnels driven along the hanging-wall of the vein. The upper or B tunnel gains a vertical depth of about 200 feet below the outcrop and has a total length of about 190 feet. From this main tunnel the vein has been exploited by short crosscuts at intervals of 50 feet. Its width varies from 3 to 9 feet. The mineralization, consisting of galena, zinc-blende, and iron pyrites associated with a quartz gangue, is irregular and inclined to be "bunchy," but it is satisfactory to note that both the width of the vein and concentration of ore-minerals improve as the end of the tunnel is approached. A sample moiled across a 44-inch width of the vein near the face gave the following results: Gold, 0.07 oz.; silver, 13.8 oz.; lead, 12.4 per cent.; zinc, 21.2 per cent.

The lower or C tunnel, driven from the bottom of the basin, gains an additional depth of about 80 feet; this is the maximum depth obtainable without driving tunnels of great length, which the present stage of development does not justify. The total length of C tunnel is about 438 feet. The vein was encountered at a distance of about 200 feet from the portal; the direction was then changed and for its last 150 feet the tunnel runs parallel to the strike of the vein in the hanging-wall. No crosscutting to prove the vein had been done in this length; hence no ore of importance had been developed from this level. It is proposed to extend this tunnel 300 or 400 feet to develop the vein below strong surface exposures to the south-east of the eroded portion. A small crew of men is now engaged in this work.

The appended sketch, made from a hurried Brunton survey, is only intended to give an idea of the "lay-out" of the principal workings and is not accurate in detail.

The *Blue Bell* workings are located on the northerly extension of the vein, at a distance of about 800 feet from the large surface exposure. A crosscut tunnel driven in a westerly direction into the face of a small bluff struck the vein at 150 feet. Here the vein shows a strong width of quartz, in which the pay-streak varies from a few inches to 3 feet in thickness. About 150 feet of drifting has been done, above which the ore has been stoped.

In order to gain depth a crosscut was started at the bottom of the bluff, 132 feet lower down. This has been driven for 150 feet. From near its portal another tunnel has been driven for a distance of 210 feet in a north-westerly direction, following a small stringer which was thought to be the vein. Although time did not allow of a survey being made, in the writer's opinion it was doubtful if this latter tunnel was on the vein. A further endeavour to develop the vein at depth should be made, as a considerable tonnage of very nice silver-lead ore was extracted from the upper level.

The shipments made by the company during 1908 and 1909 make up a total of between 200 and 300 tons, of which the average would run about as follows: Gold, 0.10 oz.; silver, 74 oz.; lead, 24 per cent.; zinc, 10 per cent. The future of this property as a large producer would seemingly depend upon the results obtained by the continuation of the C tunnel.

Arrow Lake Mining Division.

In this Division the *Millie Mack* mine near Burton was operated by the owner, H. E. Forster. Three men were employed. About 12 tons of high-grade silver-lead ore was extracted and shipped.

It is reported that the *Mountain Chief* mine at Renata has reverted to the original owners, who have commenced work on the property.

NORTH-EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

REPORT BY G. E. SANBORN, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the Golden Mining Division of the North-east Kootenay District.

I regret that so little has been done in mining in this district during the year 1921. No shipments of ore have been made.

Some considerable interest in mining has been evidenced in different parts of the district. Development-work has been done on mica claims in the Kinbasket Lake region, and an interest in the *Rustler* claim at End creek, in the Big Bend, has been acquired by Calgary people, who propose to develop it.

Information is at hand that after investigation an English syndicate has secured a group of claims in the International basin and work on them will be proceeded with as soon as weather conditions will allow.

Interest is also manifested in placer-mining on Canyon creek. As it was late in the season when any claims were staked, not much was done, but it is expected that when the ice moves in the spring work will be resumed.

OFFICE STATISTICS—GOLDEN MINING DIVISION.

Free miners' certificates (ordinary)	91
Free miners' certificates (special)	1
Mineral claims recorded	19
Placer claims recorded	1
Certificates of work issued	11
Conveyances (mineral)	3

WINDERMERE MINING DIVISION.

REPORT BY E. M. SANDILANDS, MINING RECORDER.

I have the honour to submit my report for the Windermere Mining Division for the year ending December 31st, 1921.

I regret to say that mining in this Division, as well as, I presume, all over the Province, has been of a very desultory character during the past year, partly due to the low prices of metals and also to the excessive and unsatisfactory terms of freight and treatment.

Furthermore, capital was very shy in investing in mining under the above conditions; consequently very little prospecting was done, there being no incentive to discover anything new. However, towards the end of the year things were looking a little better and the prospects for 1922 brighter. In spite of the above, the mining receipts have only fallen off about 10 per cent. in this office, this being due to money paid in in lieu of assessment-work.

Paradise.—This property worked a small force of men during the past summer, mostly doing development-work. Towards fall more men were put on and shipments resumed. The low prices of metals and high freight and treatment charges caused this mine to hold the ore until better conditions prevailed.

Bunyan.—This property is owned by the Bunyan Barium Syndicate and is situated on the mountain to the rear of Invermere. The property during the summer worked an average of eight men, doing mostly development-work, and at the end of August last was closed. This company ran 300 feet of tunnel and 50 feet of raise. The ore goes high in barium, picked samples going as high as 96 per cent. The company is contemplating putting up a reduction plant for the treatment of this ore.

Maple Leaf and Silver King.—These properties are owned by the Toby Creek Mining Company and are situated on Jumbo fork, a tributary of Toby creek. During the summer a small amount of work was done and several tons of ore sacked, but owing to the low prices of metals and difficulties of getting the ore to the market the ore was not shipped. The work was under the management of W. L. Smith.

Isaac and Isaac No. 1.—Some work of a prospecting nature was done on this promising property, but no ore was shipped. W. D. McMillan, of Seattle, is now the owner, having recently completed the purchase from H. E. Forster.

Vermilion and Margaret.—These properties are owned and operated by the Zenith Mines, Limited, of Calgary. Several tons of ochre ore has been shipped from these claims. The ore is hauled over the Banff road to Castle, a siding on the Canadian Pacific Railway. I have no record of where it is shipped.

The *Outlook*, *Evening Star*, *White Star*, and *Silver Spray* groups have all had their annual assessment-work done, and on some more than the regular work was done. The work performed, I hear, gave encouraging results. These groups are all on Toby creek and tributaries.

Office Statistics—Windermere Mining Division.

Free miners' certificates issued (ordinary)	64
Free miners' certificates issued (special)	1
Claims recorded (quartz)	35
Certificates of work issued	75
Certificates of improvements	2
Bills of sale, agreements, etc.	22

SOUTH-EAST KOOTENAY DISTRICT.

FORT STEELE MINING DIVISION.

REPORT BY N. A. WALLINGER, GOLD COMMISSIONER.

I have the honour to submit a report on the progress of mining in the Fort Steele Mining Division for the year 1921.

In reviewing the mining conditions since my last report, a steady progress and improvement can be reported; more prospecting and development has been attempted, and in quartz-mining, particularly with regard to free-milling ores, a much stronger interest is being shown.

Placer-mining has been general over all the gold-bearing creeks, the prospects in most of them being good, and all of them will be in full blast next spring. Returns from Wildhorse are increasing, but the camps on Weaver and Perry creeks and the Moyie river are only in prospecting stage.

The work of the Consolidated Mining and Smelting Company at the *Sullivan* is rapidly opening out, and a commencement on the site of the concentrator between Marysville and Kimberley has been made; a site for a power plant has also been selected and water applied for from Skookumchuck creek; this when completed will ensure an independent supply of electrical energy, the power-line being perhaps 15 miles long. The shipments from the *Sullivan* mine in 1921 are: Lead ore, 33 tons; zinc ore, 297,210 tons; iron pyrites, 1,121 tons. Improvements made during the year include five new cottages and one large bunk-house, the burnt building having been rebuilt.

At last it seems as though some attempt is to be made to ascertain the value of the free-milling gold-quartz properties on Perry creek. It is understood that a tunnel will be run this winter to tap the big vein on the Cranbrook Homestake Company's property at a 400-foot depth, and a 10-stamp mill complete with recovery-plates and cyanide-vats installed, should the results prove satisfactory. A deal on another group is pending; these two represent the typical ores on Perry creek, and the success of either will be a matter of much importance to the district.

On the West fork of Hellroaring creek a little development is being pushed on an old property, and on the successful results of this work a great deal depends, as a systematic plan of development would be inaugurated at once.

Work has been continued on the *Victor* group during the season, but no results have been ascertained; the camp has been closed down for the winter, but is to be reopened in the spring.

The Federal Mining and Smelting Company, which had taken a bond on the *Stemwinder* group, situated on Mark creek, between the *Sullivan* and the *North Star* groups, has stopped work, the results being disappointing; this group is the property of Mann & MacKenzie and has a large body of pyrrhotite, carrying galena and zinc-blende. A bond on a property on Copper creek, the *Brenda* group, has been completed and work is proceeding; the camp has been established and a shaft is now being sunk; the ore is a grey-copper in a quartz gangue, carrying good values in gold and silver.

There have been two locations of graphite made in widely separated districts, Matthew creek and Wildhorse creek, but until more work is done nothing can be said as to their value.

No further work on the *Rob Roy* group on Skookumchuck has been done where the native copper was struck, but it is understood that a new company is to carry on development to a greater depth.

OFFICE STATISTICS—FORT STEELE MINING DIVISION.

Mineral claims recorded	168
Certificates of work (Form E)	235
Certificates of improvements	15
Bills of sale, etc.	111
Mining leases issued	3
Free miners' certificates (ordinary)	226
Free miners' certificates (company)	4
Crown grants issued	49

Revenue.

Free miners' certificates	$ 1,456 00
General mining receipts	3,973 90
Tax on Crown-granted mineral claims	2,151 75
Tax on mines and minerals	21,356 46
Total	$28,938 11

NORTH-WEST KOOTENAY DISTRICT.

REVELSTOKE AND LARDEAU MINING DIVISIONS.

REPORT BY ARTHUR JOHNSON, GOLD COMMISSIONER.

I have the honour to submit herewith a report on the mining conditions within the Revelstoke and Lardeau Mining Divisions for the year ending December 31st, 1921.

REVELSTOKE MINING DIVISION.

ALBERT CANYON CAMP.

The *Lanark* mine was in operation with a crew of men doing development-work during the spring months, but since June all work ceased and this property is now idle. It is the intention, however, of the management, we are informed, to commence with a full crew of men early next spring to continue development. No ore was shipped from this property during the year.

A crew of five men has been employed steadily during the year on the *Waverly-Tangier*. The men were chiefly engaged in clearing the old workings of the mine and development. Eight men were engaged for three or four months in clearing the wagon-road to this property.

The *Silver Creek* mines, situated on Silver creek, about 7 miles from Albert Canyon, were idle during the season, only assessment-work being undertaken.

BIG BEND DISTRICT.

Nothing of importance was undertaken in the way of the development of either the lode or placer properties in the district during the past year.

OFFICE STATISTICS—REVELSTOKE MINING DIVISION.

(John Lee, Mining Recorder.)

Free miners' certificates	110
Special free miners' certificates	1
Mineral claims recorded	35
Placer claims recorded	2
Certificates of work recorded	47
Payments in lieu of work	3
Placer leases granted	3
Agreements and transfers recorded	2
Permissions recorded	1

LARDEAU MINING DIVISION.

The Camborne camp was exceptionally quiet during the year. The *Multiplex* mines, of which O. T. Bibb is the manager, kept a small crew of men working on their properties doing development-work.

Charles Harvey and associates put in considerable development-work on their gold properties situate on Pool creek, a few miles above Camborne, with good results. It is the intention to proceed with work again when the season opens up next spring.

OFFICE STATISTICS—LARDEAU MINING DIVISION.

(Ernest Roberts, Mining Recorder.)

Free miners' certificates issued	25
Locations recorded	25
Certificates of work issued	54
Bills of sale recorded	10
Powers of attorney	2
Grouping notices	10

SLOCAN DISTRICT.

AINSWORTH MINING DIVISION.

Report by Ronald Hewat, Gold Commissioner.

I have the honour to submit herewith the annual report on mining operations in the Ainsworth Mining Division for the year ending December 31st, 1921.

Owing to the small demand for metals and the high costs of mining there has been very little mining development done in my district this year.

During the first three months of 1921 the *Bluebell* mine mined and treated 3,350 tons of ore from surface workings; but metal prices, the nature of the ore, semi-oxidized as it was, and high costs combined, rendered an operating margin impossible of attainment.

The Utica Mines, Limited, employed an average of four men, worked ninety-seven days, and shipped 45 tons of ore containing 5,402 oz. silver and 8 tons lead, but no new buildings or improvements were made, other than that of driving drifts and raises to facilitate the extraction of the ore.

On the *Kirby* group, owned by A. J. Curle *et al.*, and situated at Riondel, on Kootenay lake, a tunnel was driven from the lake-shore 290 feet in order to crosscut the lead, which the owners expect to pick up in another 100 feet. The surface exploration done during 1921 uncovered another well-defined vein conforming to the formation, apparently from 30 to 40 feet wide, about 80 feet farther up the hill than No. 1 lead, and in which there is a good showing of ore right at the surface, and in addition four other veins from 2 to 4 feet wide cutting the formation were also found, all of them showing pay-ore.

Office Statistics—Ainsworth Mining Division.

Free miners' certificates	157
Free miners' certificates (company)	5
Mineral claims located	63
Certificates of work recorded	401
Certificates of improvements	8
Bills of sale, agreements, etc.	35
Dredging leases recorded	8
Leases of reverted mineral claims	12

SLOCAN MINING DIVISION.

Report by Angus McInnes, Mining Recorder.

I have the honour to submit herewith my annual report on the Slocan Mining Division for the year ending December 31st, 1921.

I regret to have to say that there has been very little improvement in conditions over last year. We have not yet recovered from the effects of the disastrous strike of last year, together with the slump in the price of the metals we produce.

The only mines working this last year were the *Silversmith* at Sandon, the *Bosun* at New Denver, and the *McAllister* at Three Forks. The first-mentioned property has purchased the *Ivanhoe* mill and enlarged it to about double its former capacity; they have also built a tram-line from the mine to the mill and are now ready to operate on a large scale. The *Bosun* ships very high-grade ore in fairly large quantities. About thirty miners are employed.

The *McAllister* is only doing development-work for the winter. In the spring I understand they are going to erect a concentrator at Three Forks and run a tram up to the mine, about 4 miles. Besides the above, there are about thirty sets of leasers operating in the different mines around the camp; they are reported to be doing well.

Office Statistics—Slocan Mining Division.

Mineral claims recorded	20
Certificates of work recorded	96
Free miners' certificates recorded	120
Revenue collected	$2,683.50

SLOCAN CITY MINING DIVISION.

REPORT BY T. McNEISH, MINING RECORDER.

I have the honour to submit my report of mining conditions in the Slocan City Mining Division for the year 1921.

The effects of the strike are still being felt in the Slocan and very little has been done outside the usual assessment-work required. Very little new capital is coming in, but a few properties have been operating and have given very encouraging results.

I append herewith a memorandum of what properties have been working during the year.

The *Arlington* mine, which is under lease and bond to R. R. Hedley, is getting out some rich ore. There is an opening there for capital to put in a cyaniding plant, and there is sufficient power at hand to operate the mill.

The *Anna* group, owned by Kurt Zimmerman, is being worked by a small force of men which is getting out some rich ore in course of development. This property adjoins the *Ottawa* mine.

The *Little Tim* is owned by D. B. O'Neail and A. S. McAuley, who have been doing development-work and taking out some ore, and have a car nearly ready for shipment to the Trail smelter.

The *Ottawa* mine is under lease and bond to L. H. Biggar and associates, who have had their tube-mill in operation during the last year and have made a few shipments to Trail smelter. They have had considerable difficulties to overcome in the completion of their plant and in the securing of pebbles and lining, but now have a steel lining and are changing to steel balls instead of pebbles. What has been put through has shown a saving fulfilling all expectations of the lessees. Further development and ore-output will be done in the spring of 1922.

The *Black Prince* is under lease and bond to J. T. Tipping, who has made one shipment and has two more cars to come out in the spring.

The *Hampton* is under lease and bond to Wafer, Barber & Maurer, who have struck it rich and are taking out some high-grade ore, and with spring will be on the list of shippers. This mine was one of the early producers, but has been idle for a number of years. It is now, however, proving better than ever.

The *E. & R.* group, owned by Frank Benish and Joe Daniels, is being well developed. A new crosscut is being driven to tap the lead at depth, and it is believed that with the striking of the lead this will be a shipper, as some very high-grade ore has been found during development-work. The parent body has not yet been struck.

The *Tamarac*, under lease and bond to M. Cameron, has a fine showing of ore and will be shipping in the spring as soon as it is possible to get the ore out.

The *Lily B.*, owned by George Long and associates, is being worked by a small crew. It has several shoots of high-grade ore in sight and will be shipping in the spring.

The *Richmond* group, owned by F. Franz, who has been doing considerable development-work, has a large lead which, if it develops into a shoot, will be a large one. Considerable high-grade ore has been encountered in all the driving, but it has not been continuous.

The *Silver Crest* group has had considerable work done on it during the past year and will be developed on a larger scale in the spring.

OFFICE STATISTICS—SLOCAN CITY MINING DIVISION.

Free miners' certificates issued	66
Certificates of work recorded	96
Locations recorded	25
Transfers recorded	6
Notices to group	9
Free miners' certificates	34
Marriage licences	1
Total receipts of office	$967 30

TROUT LAKE MINING DIVISION.

Report by Oscar Jacobson, Mining Recorder.

I have the honour to submit herewith my report for the Trout Lake Mining Division for the year ending December 31st, 1921.

Owing to the general depression of business the mining industry did not come up to what was expected during the year; only two properties were worked (by leases) to get out ore—namely, the *Silver Cup* and the *Nettie L.*—and a small tonnage of ore was shipped from each of them.

Development-work was started early in the fall on the *True Fissure* property and will continue all winter. A very good strike of calcite was located on Lake creek and three claims located. The locators have great hopes of the find, as they expect a New York party to come in during next summer to look over the discovery.

The usual amount of assessment-work has been done during the year and new locations of claims have kept up with former years.

Placer-mining took a new lease of life during the summer; two dredging leases were granted by the Gold Commissioner and seven claims were recorded.

B. T. O'Grady, Assistant Engineer to A. G. Langley, of Revelstoke, came in during the later part of the fall to look over some properties, and will no doubt give his report on them.

Office Statistics—Trout Lake Mining Division.

Free miners' certificates issued (ordinary)	52
Free miners' certificates issued (company)	1
Mineral claims recorded	25
Placer claims recorded	7
Certificates of work recorded	144
Certificates of improvements recorded	6
Transfers recorded	11
Dredging leases granted	2

NELSON DISTRICT.

NELSON MINING DIVISION.

REPORT BY J. CARTMEL, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the Nelson Mining Division for the year ending December 31st, 1921.

Owing entirely to prevailing economic conditions, the year has been an exceedingly poor one from the mining standpoint so far as this particular Division is concerned, and while I consider it unwarranted at the present time to indulge in any optimistic speculations regarding the immediate future, it is only fair to mention that, judging by a number of inquiries received from the United States of America and England by local mining men for particulars as to gold-producing properties, it would appear that a certain amount of optimism is justified.

A considerable amount of development-work has been done, but shipments to the smelter were almost negligible, amounting to little over 100 tons.

Nugget.—The Nugget Gold Mining Company continued work on its properties, situated on Sheep creek, and for several months kept the *Motherlode* mill running steadily, with good results, I understand.

Granite-Poorman.—This well-known mine, which is one of the oldest producers in the district, was bonded early in the year, the present operators confining themselves strictly to a development policy, and much interest is centered on the outcome of the venture.

Reno Group.—The Reno Gold Mines, Limited, has organized with a capital of $1,000,000 and is pursuing a vigorous policy of development with the properties on Fawn creek, a tributary of Sheep creek. Reports point to its becoming a large gold-producing mine.

Bayonne Group.—I learn that a Spokane syndicate has bonded this property and, in addition, several other promising groups of claims in the same locality, and it looks as if this section of the district is at last coming into its own. From all reports there are many hundreds of thousands of dollars' worth of ore in sight.

Spokane Group.—No shipments were made from this property during the year, although the owners are said to have ore to the value of some $100,000 ready. Lack of transportation facilities appears to be the only reason for these valuable properties in the Bayonne section remaining quiescent, and it is hoped that some amelioration of this condition will be evident during the coming year.

Yankee Girl.—This mine has been idle all year since the 10th of December, 1920, at which time it was closed down. It is understood that negotiations are under way for reopening this property, which has produced over $500,000 up to date.

Dundee.—This mine, which adjoins the last named, is still idle, but I understand that there is some hope of English capital being interested in the property before long.

Mayflower. The Gibraltar Mining Company, with headquarters at Waverly, Wash., has been running a crosscut tunnel on this claim and has driven same about 225 feet toward a "showing" on the trail to the *Mayblossom* and *Free Silver* claims, which is said to lack about 20 feet of reaching its objective, the depth attained being about 125 feet at the present face. The property is situated about 1½ miles west of Ymir, on the Quartz Creek side of the divide between Boulder and Quartz creeks.

Goodenough Group. This property, adjoining the old *Ymir* group, has recently been further developed by means of a drift on the vein 300 feet lower than the collar of the two shafts, which latter are down about 40 to 50 feet each on parallel veins some 30 feet apart at the apex of the hill, where the only known showings were visible until this new tunnel was driven. The new tunnel has encountered the vein in-place at a point about 600 feet west of the shafts, and is said to be exceptionally strong

where recently shown up, being some 6 feet wide from wall to wall, with quartz about 2½ feet wide, plentifully mineralized; but I am not aware that any assays have been made since the vein was encountered, so I am unable to state whether or not commercial ore has yet been reached. The big ore-shoot of the adjacent *Ymir* mine, together with a strong vein running parallel, are the encouraging features about this property.

Perrier.—This property, although it is supposed to have been bonded during the year, has not been operated so far as I am aware.

Gold Hill Group.—This property, situated on Forty-nine creek, was worked most of the year. Two cars of ore shipped to Trail smelter netted, I am told, $50 a ton in gold alone, and another car is now ready for shipment.

Birdseye Group.—This property, situated near Nelson, is owned by an English syndicate, which has been steadily pushing development during the year, resulting, I am informed, in disclosing a promising vein of gold ore.

Noonday Group.—This property, situated on Sitkum creek, 9 miles from Nelson, was idle during the winter, lack of capital being the reason, I understand.

California.—This group, situated near Nelson, is being operated by a Spokane syndicate, which has also taken over the *Athabasca* group and mill, which latter was run continuously during August and September, putting through the ore in the bins which was stoped from the *California* last winter. An average of 6 men was employed. A new raise is being started immediately.

It is rumoured that a deal is pending for the *Queen* mine on Sheep creek, which has not produced for several years, but is credited with a total production of about $2,000,000 in gold.

Another well-known mine which has lain dormant for some time, but which is assuredly capable of producing a large tonnage for years to come, is the *Second Relief* on the North fork of Salmo river, about 14 miles from Erie, a reconstruction of the affairs of which, rumour has it, is under way.

A new location which shows considerable promise is the *Champion* group of two claims—*Champion* and *Champion No. 2*—staked in the spring by S. N. Ross, of Salmo. These claims are situated near Park Siding and some good ore is reported to have been struck, 20 tons of same shipped to Trail being said to have given excellent returns.

There are a number of other properties with good showings in the district, their owners mostly being prospectors who, for lack of capital, are unable to develop their claims. They would no doubt be willing to lease or bond, so that there seems to be plenty of scope within this Division for investors looking for promising gold properties.

Placer.

A group of four placer claims aggregating 1,000 feet in length were staked on the North fork of Salmo river, about 2 miles from Erie, in the fall, by four miners calling themselves the Carlson Partnership. This locality had been worked in former years and some fairly coarse gold recovered, but insufficient, no doubt, to make it a really remunerative proposition.

Considerable dead-work has been done by the new locators, including the building of several hundred feet of ditch and installing of sluice-boxes, and a quantity of overburden has been removed by ground-sluicing. There is evidently some fairly coarse gold in the gravel, but the men are hampered in their operations by the numerous very large boulders in the ground, and also claim that the false bed-rock of clay, on which the values apparently lie, robs the boxes of considerable of the gold.

As these claims are located on land which has passed from the Crown, the partnership was required to furnish security to cover possible damages. This they apparently had no difficulty in doing, and provided satisfactory bonds to the extent of $1,000, thereby showing that they are in earnest in the endeavour to make the operation a success.

The only other placer claim recorded during the year was on Forty-nine creek, where an old placer-miner has been working and employed another man for a time, but as he was then engaged in dead-work it is unlikely that the employed man's wages came out of the ground, but rather out of his employer's pocket. There is undoubtedly placer gold on this creek, and it is to be hoped that the old-timer's courage and industry will eventually be amply rewarded.

OFFICE STATISTICS—NELSON MINING DIVISION.

Free miners' certificates (individual)	438
Free miners' certificates (company)	6
Free miners' certificates (special)	1
Mineral claims located	200
Certificates of work recorded	348
Mining claims (placer) (under two records)	5
Transfers, agreements, etc.	72
Certificates of improvements	19

ARROW LAKE MINING DIVISION.

WALTER SCOTT, MINING RECORDER (OFFICE AT NAKUSP).

I have the honour to submit the annual report on the Arrow Lake Mining Division for the year ending December 31st, 1921.

Millie Mack.—H. E. Forster has had men doing development-work all summer, and has 16 tons of ore sacked up ready for shipment when snow comes; 12 tons was shipped in January.

Tillicum Group.—This property comprises the *Tillicum*, *Cultus*, and *Valley View* claims and is owned by Reveler & Robson, who have been working all summer on the property and have 4 tons of shipping-ore on the dump. Assays from the property ran: Gold, $40 to the ton; silver, 100 oz. to the ton. The property is looking well.

Hoodo Group.—Owned by Prough & Reimer, who are getting out shipping-ore. The property is looking well.

OFFICE STATISTICS—ARROW LAKE MINING DIVISION.

Free Miners' certificates	55
Special free miners' certificates	1
Certificates of work recorded	7
Mineral claims recorded	15

ROSSLAND DISTRICT.

TRAIL CREEK MINING DIVISION.

Report by H. R. Townsend, Gold Commissioner.

The only new development in the mining situation in this district during the year has been on the *I.X.L.* property, which is being worked by a local syndicate under a lease. Twenty-three tons of high-grade free-gold ore was taken out; the lessees are continuing and are greatly pleased with their prospect.

The Velvet Syndicate continued work on the *Velvet* until the snow came, when they shut down owing to the difficulty of shipping, as it was found impossible to get teams to transport the ore down to Northport, to which point it must now be taken as the Great Northern ceased operating their trains into the Province last fall.

The Consolidated Mining and Smelting Company of Canada, Limited, has continued with a small force of men on the Rossland properties and shipped 82,092 tons to the smelter.

The *Le Roi No. 2* kept a force of about forty men at work and experimented on a milling process, the success of which is not yet fully determined.

Alexander Constantine has done considerable work on the *Pearl* mineral claim on Record ridge; he is sanguine that the property will prove satisfactory and has brought in some encouraging samples.

As a result of the rich ore struck on the *I.X.L.* some Eastern people came in and inspected some properties owned by them in this vicinity, and expressed their intention of commencing operations on their claims as soon as possible in the spring.

Office Statistics—Trail Creek Mining Division.

Free miners' certificates (individual)	99
Free miners' certificates (company)	4
Free miners' certificates (special)	1
Mineral claims located	23
Certificates of work recorded	53
Bills of sale	4
Certificates of improvements	1
Placer leases	1
Leases of reverted mineral claims	5

SOUTHERN DISTRICT (No. 4).

REPORT BY PHILIP B. FREELAND, RESIDENT ENGINEER.

INTRODUCTORY.

The above district, comprising four Mining Divisions—Grand Forks, Greenwood, Osoyoos, and Similkameen—is situated in the extreme south centre of the Province of British Columbia.

A good deal of time was spent in the examination of properties in the Vernon and Ashcroft Mining Divisions, which prohibited some exploration-work planned on the headwaters of the Roche and Skagit rivers. Reports came in last year of some attractive low-grade silver veins from that locality, but nothing could be done until transportation was improved.

A glance at the prices of metals for the year will account for the large decrease in tonnage in this district as elsewhere. Only the higher-grade silver-lead mines were able to continue operations, and it is doubtful if they did much more than pay expenses.

Towards the end of the year the gradual increase in the price of copper and a decrease in the operating costs again stimulated interest in mining. Owners of gold properties, unable to operate for the past year and a half, are overhauling their plants and doing development-work with the intention of active operations in the spring.

A good many individuals and small companies have been intensively prospecting the old placer-grounds of Rock creek, Granite creek, and the Tulameen river, with indifferent results. It seems unlikely that such prospecting, without the aid of core-drills, will more than pay wages, for history relates that nearly all the shallow ground has been placered, first by white men and then by the Chinese, which leaves small opportunity for those who come after. In the bottom of the creeks and rivers there is a good chance of finding gold, as these areas were beyond the reach of the individual twenty years ago on account of the lack of equipment.

In 1918 the Munitions Resources Commission reported as follows: "Below the mouth of Slate creek and for 3 miles down-stream the Tulameen river widens out to an average of 900 feet, and the gravel lies in large bars and low-lying benches at depths from 20 to 100 feet." The total area was estimated by the Board to be about 15,000,000 cubic yards, most of which consists of heavy, coarse pebbles, with many boulders about a foot in diameter. Large boulders are occasionally encountered, but are by no means numerous and should not present any insuperable difficulties in dredging operations.

Eleven holes were put down by the Commission, the deepest being 72½ feet and the shallowest 11 feet, with a total of 516 feet drilled. Six holes were put down to bed-rock, the others being stopped at depths at which values did not warrant further drilling. These holes only covered a small portion of the area near Slate creek, and consequently nothing definite can be said about the value of the whole ground for dredging operations, but they were attractive enough to justify more drilling to prove its possibilities.

The reason that the Munitions Commission did not continue to search was that platinum was needed at once and the drilling of the entire area and installation of a dredge would take about twelve months to accomplish.

The ground between Tulameen and Princeton, about 20 miles distant, has never been worked owing to the fact that the gravels are heavy and generally deep. Detailed results of the sampling of the Tulameen gravels by core-drills by the Munitions Commission are to be found in their report published in 1920, together with a map of the river showing the location of the drill-holes.

PROSPECTING.

It seems likely that most of the ore-deposits of large dimensions showing a mineralized outcrop have been discovered, although in a great many cases they have not been thoroughly prospected, but Crown-granted before a proper idea of their value can be estimated. There are, however, as already proved in the Phoenix camp, many ore-bodies that do not outcrop and do not show any mineralization, though close to the surface. These covered areas often occur on a contact of limestone with an igneous rock or in a depression where the gangue of a lead happens to be of softer material than the surrounding rock.

Jewel Lake, Greenwood M.D.

White Lake, Osoyoos M.D.

Prospecting in the district has fallen off considerably in the past three years, owing not only to the low price of metals, but to the idea that the district has been thoroughly prospected, which is not the case.

I have mentioned in previous reports that the district is better equipped with railway, wagon-roads, and electric power than any other part of British Columbia, which is a most important feature when considering the prospective assets of a mine.

There are two possible placer-grounds that have not received much attention in the past—i.e., the benches along Pass creek, as well as the creek-bottom itself near its source. Jewel (Long) lake formerly discharged into Pass creek, and from thence into the Granby river. Also in the vicinity of Fairview, where there are many quartz leads bearing free gold.

The headwaters of the main Kettle river and Cherry creek also have developed placer-grounds, which have not been thoroughly prospected. Some coarse-gold nuggets were brought in from that region this year.

Diamonds.

Whilst prospecting for the ordinary minerals in and near the dunite and serpentine dykes which frequent the district, especially in the neighbourhood of Cascade, Grand Forks, Greenwood, Rock Creek, and Tulameen, the prospector would do well to remember that these rocks in some parts of the world, including Tulameen, B.C., and Arkansas, U.S.A., contain diamonds. The Tulameen rocks contain only microscopic diamonds associated with the chromite so far as research has shown. Little investigation has been made in the placers.

Most of the larger diamonds in other parts of the world have been found in the oxidized or serpentinized zone. There are fairly large areas of this serpentine in the Wellington camp, near Phoenix, and also above Cascade. In the Arkansas serpentine there is no chromite present.

The larger valleys present rather too big a field for the prospector, so it is advisable to confine his efforts to smaller depressions near the serpentine when searching for diamonds in the gravels.

Microscopic diamonds have been found in the gravels adjacent to the serpentine rocks in the Boundary country.

Total Tonnage and Contents in Mining Divisions for 1921.

Division.	Ore.	Gold.	Silver.	Copper.	Lead.	Fluorspar.	Coal.
	Tons.	Oz.	Oz.	Lb.	Lb.	Tons.	Tons.
Grand Forks	40,411	541	5,745	432,505	.....	6,742	.....
Greenwood	402	69	111,624	.....	51,268	....	.....
Osoyoos	845	125	42,682	.....	.....	....	.....
Similkameen	.....	.....	.....	.....	.....	....	77,310
Totals, 1921	41,658	735	160,051	432,505	51,268	6,742	77,310

A total of 14,869 tons of lime-rock was shipped from the Fife quarries to the Trail smelter for fluxing purposes.

OSOYOOS MINING DIVISION.

Hedley Gold Mining Co.

Operations in the mine and mill were suspended until autumn of 1920 on account of the high cost of operation. During the summer development-work commenced in the mine, followed by repairing the mill and dam, preparatory to active operation in the spring or as soon as the ice has gone from the Similkameen river. Portions of the flume on Hedley creek have been destroyed and will have to be repaired before water can be obtained for milling purposes. The Provincial Government lent assistance in repairing the bridges on Hedley creek to enable the company to haul lumber for the flume.

Peggy and Rawhide Group.

This group consists of the *Peggy*, *Rawhide*, *R.L.*, and *Portland* claims, owned by Jim Walker and D. H. McKinnon, of Hedley, and is situated on the south-west side of Hedley creek at an elevation of about 2,400 feet above Hedley, 2 miles distant. Nearly the entire group is on the Chuchuwha Indian Reserve

and the owners have been unable to get permission from the Indians to ship any ore, so that further exploitation seems inadvisable for the present.

On the *Peggy* an open-cut 15 feet wide in a highly siliceous limestone shows pyrrhotite, pyrite, and specks of chalcopyrite.

On the *Rawhide*, which lies farther down the slope of the creek, a tunnel has been driven in 35 feet, cutting the limestone and silicified wall-rock. The limestone is well mineralized with pyrite and chalcopyrite. A sample taken over 15 feet gave: Gold, trace; silver, 1 oz.; copper, 1.70 per cent. There are good possibilities on this claim, as in the vicinity there are many outcrops of limestone well altered and containing iron and copper.

Horn Silver Mine.

Active operations were carried on through the year by this company under the management of B. Powell, of Similkameen. Most of the work was confined to the lower tunnel and 845 tons of gold and silver ore was shipped to the smelter. This is one of the few properties which have operated continuously since 1914. About fifteen men were employed during the year.

White Lake Basin.

Development-work by means of a tunnel about 200 feet long opened up a 4-foot seam of coal, said to be of a good variety. The owners, who are now incorporated as the White Lake Collieries, Limited, with offices in West Summerland, state that they intend to put a diamond-drill on the property to exploit it thoroughly. Analyses of coal taken from the development-drift showed a higher fixed carbon and lower ash percentage than near the surface. It is to be hoped that this condition will persist at depth.

Silver Crown.

This claim is situated about 1½ miles from the east side of the Similkameen river, on the International Boundary-line. A wagon-road has been built from Oroville, Washington, up the Similkameen river on the east side, and a rough branch from this to the claims. The first work was done upon the *Submarine* mine, located on the United States side of the boundary and adjoining the *Silver Crown*.

The vein on the *Submarine* claim varied in size from 10 to 15 feet in width and was exploited by means of open-cuts, a shaft, and two tunnels; one tunnel under the vein 400 feet in length and another drift on the vein 585 feet. The greater part of the lead in the upper tunnel passed through what appears to be an exceedingly low-grade quartz. Occasionally segregations of mineral showing argentite, chalcopyrite, galena, and iron, with a small percentage of calcite, are found. These minerals carry very high values in gold and silver.

The work on the *Silver Crown* was done after the development of the *Submarine* and shows a continuance of the lead of about the same size, striking generally N. 75° E. (mag.) and dipping nearly flat. Tunnels 90, 95, and 100 feet respectively, from 50 to 100 feet apart, form the development-work done on this claim. The lead here exposed is undoubtedly a continuation of the *Submarine*, for it is traced by open-cuts on the surface for 1,500 feet.

The quartz in the tunnels of the *Silver Crown* is crushed and oxidized in the fractures and carries low values in gold and silver. A thorough sampling of the vein will have to be made before any definite conclusion can be arrived at regarding possible profitable operation. The high values in the segregations added to the lower values of the main body of quartz may make an average tonnage value which would pay the owners. It might also be advisable, if possible, to continue the development on the *Silver Crown* to a point where the lead dips into the hill and the oxidized zone is passed.

The location of these claims, within 2 miles of the Great Northern Railway and about 4 miles from the high-power station, makes them attractive from a transportation and cheap fuel standpoint.

King Edward Group.

This group of claims, consisting of the *King Edward*, *Bank of England*, and *Yellow Jacket*, lies on a high ridge between Hunter creek and Susap creek, about 3 miles from the Similkameen river on the west side, 10 miles south of Keremeos. Most of the work on these claims was done many years ago, except on the *King Edward*, which was exploited during 1918 for its molybdenum content. A tunnel was driven 35 feet on a quartz lead varying in thickness from 1 to 20 feet. About 4 feet on the hanging-wall near the face of the drift was well mineralized with chalcopyrite, pyrite, and molybdenite. Samples taken from this lead over 4 feet gave: Gold, trace; silver, 1 oz.; copper, 1.60 per cent. Several open-cuts were excavated about 100 feet west of the tunnel, where there was a strong indication of molybdenum in the fractures of the granite.

On the *Yellow Jacket* a 25-foot shaft has been sunk, following small fractures in the granite filled with pyrite, chalcopyrite, and copper carbonates. A tunnel 30 feet long was also driven on a small mineralized fracture about 2 inches wide.

On the *Bank of England* a tunnel had been driven 60 feet and a cross-cut from the face about 30 feet. There was a small stringer of sulphides of iron and copper on one side of this tunnel which was too small for any tonnage prospect.

Fairview Camp.

Boyles Bros., of Spokane, Washington, did several hundred feet of diamond-drilling for Eastern capitalists in this camp. It is generally understood that drilling will proceed when the weather conditions improve. The large quartz veins in this vicinity contain some free gold, and if the values are as persistent in depth as on the surface, active operations may be looked for in the future.

SIMILKAMEEN MINING DIVISION.

Canada Copper Corporation.—This company continued to be inactive during the year, chiefly on account of its inability to operate at the low price of copper. If the price of metals continues to rise, it is probable that during 1922 work will commence. There are several slides and washouts on the railway between Princeton and the mine which will have to be cleared away and filled before any ore can be shipped to the mill or concentrates to the smelter.

Princton Coal and Land Co.—Production was carried on throughout the season on the company's property at Princeton, and the total output from the mine amounted to 13,966 long tons of coal, of which 10,756 long tons was sold and shipped.

Coalmont Collieries, Ltd.—A good deal of hard luck accompanied the operations of this company at Coalmont during the year. Amongst minor mishaps were the loss of a large portion of new cable by fire and several breaks in the operating cable, which delayed operations in the mine. The total shipments made were 59,709 long tons of coal. Development-work amounted to about 1,250 feet of main tunnel on No. 3, with a counter-level 1,600 feet, with development panels between and above. No. 2 level was not extended, but developed by a counter-level and panels.

Princeton Mining and Development Co., Ltd.—This company owns the *Copper Farm* mine, situated about 4 miles east of Princeton. Last year a 3-drill Rand compressor and 80-horse-power boiler were installed. This year the lower main drift was extended and an upraise driven 125 feet to connect with No. 2 level. It will require about 75 feet more upraising to connect to two levels. Some small stringers of copper sulphides and carbonates were struck in the raise and an oxidized zone developed at the top of the raise. The location of these claims within a few hundred feet of the Great Northern Railway and river is good, and should an ore-body be developed the expense of operation could be kept at a minimum. Future development is looked forward to with interest. The property is managed by Fred Foster, of Princeton.

Roche River Section.

Red Star and Anaconda. These claims are owned by Bonnybier & Pouel, of Princeton. The lower crosscut tunnel, driven 500 feet, was abandoned for the present on account of bad air. A new open-cut was started farther up the hill with the idea of tracing the vein on the surface as a future guide to driving the lower crosscut tunnel. The upper workings consist of three tunnels, 250, 400, and 65 feet respectively, in the mineralized zone, in which there are lenses of chalcopyrite carrying gold and silver varying in thickness from a few inches to 4 feet in a gangue of quartz. Unfortunately the upper tunnels were partially caved owing to the crushed and slippery nature of the schistose formation, and only a part of the workings could be examined. Over an area about 500 feet in length and 200 feet wide copper carbonates were seen in the fractures of the rock.

Knob Hill. The owner of this claim, John Bowman, of Princeton, continued driving a crosscut tunnel at an elevation 50 feet below the open-cut and shaft, which proved a shear-zone containing 4 feet of ore carrying chalcopyrite and chalcocite, as well as carbonates of copper. About 60 feet from the mouth of the crosscut tunnel what appears to be a parallel lead was cut, containing values up to 3 per cent. copper and a trace of gold and silver. The lead strikes N. 50° W. (mag.) and dips 50° S.W. The surrounding formation is a sericite schist.

SUMMIT CAMP.

Bluebell and Mountain View.

W. Hess continued the exploitation of these claims throughout the winter and early summer. Several open-cuts were excavated on the lead and a tunnel driven 80 feet, 25 feet below the cuts. Surface indications proved a very narrow stringer, traceable for over 1,000 feet in an easterly and westerly direction (mag.) Small particles of silver-lead were found in the vein, but these were not persistent. In the lower tunnel a lead was developed about 1 foot wide, carrying values in silver and lead. The country-rock is a highly metamorphosed sedimentary, cut with numerous dykes.

Stephenson's Claim.—Vancouver interests took a bond on this claim with the intention of shipping some ore. At the time of the arrival of the men the workings were full of snow and water. The data on the operations of these interests are not to hand.

LAW'S CAMP.

Assessment-work was done on some of the claims in this camp by Louis Marcotte, of Coalmont, and a better grade of ore encountered. Formerly the ore contained too high a percentage of zinc to be shipped profitably, but the new work has developed a grade higher in silver and low enough in zinc to make it a profitable undertaking. It was the intention of the owner to do more work this winter, and it is to be hoped that more ore free from zinc will be found.

TULAMEEN RIVER.

Several small parties of men continued to placer for gold and platinum along the benches of the Tulameen River in the vicinity of Olivine mountain. No information is to hand regarding the amount of gold or platinum taken out.

GRAND FORKS MINING DIVISION.

Emma.

This property, owned by the Consolidated Mining and Smelting Company, was shut down early in the year, and after mining the sills and pillars the mine was dismantled. The ore was generally low grade, carrying about 1 per cent. copper and a little gold and silver. It was valuable to the company chiefly as a flux for use in their furnaces at Trail. The total shipments amounted to 18,800 tons.

Rock Candy.

This mine was worked for a short period during the beginning of the season. Some difficulty was experienced in separating the silica from the fluorite so that the percentage of silica could be kept below 6 per cent. The lower price of the mineral and lack of demand prohibited further shipments of concentrates being made and the mine was temporarily closed. A total of 6,742 tons of concentrates was shipped from the mill.

Fife Lime-quarries.—A total of 14,869 tons of lime-rock was shipped from this property, on Christina lake, to the Trail smelter for fluxing purposes.

FRANKLIN CAMP.

Union.

The Union Mining and Milling Company was incorporated in 1920 and an endeavour made to sell stock for development purposes. The tightness of the money market and the uncertainty of the cost of supplies, etc., prohibited success along these lines for the time being. The gradual rise in the price of metals and general stabilizing of conditions point to better times in the mining business, and it is to be hoped that the owners will meet with success in their venture in 1922. The mine as it stands at present is well worth developing, and the finding of other secondarily enriched ore-bodies will greatly enhance the value of the property and make possible by combination the mining of any ore-bodies which are too low grade to mill.

Davenport and Dawn.

These claims are owned by Bert Averill, of Grand Forks, and are situated near Franklin creek in Franklin camp, about 45 miles from Grand Forks, on what is locally known as the "Black Lead" or "Pyroxenite" area. Development-work consists of a tunnel 75 feet long and a shaft 20 feet deep in and near the contact of the pyroxenite and syenite rocks. At the end of the tunnel on the contact a small lens of highly mineralized pyroxenite was cut, containing minute specks of

bornite and masses of chalcopyrite. A picked sample of this rock carried values of 11 per cent. copper and 0.11 oz. in platinum. Future development of this lens of ore will be looked forward to by those who are interested in the finding of commercial quantities of copper-platinum ore in the olivine rocks.

Maple Leaf. At the request of the stockholders of the Maple Leaf Mines Company, most of whom are residents of the United States, a careful sampling of the lower workings was carried out. During the past few years remarkable results were obtained, presumably from samples taken from the mine by the former management and others. These samples showed a fairly high percentage of lead, copper, gold, cobalt, and platinum, as well as its alloys, resulting in a good deal of speculation by the public. The results of samples taken on a tonnage basis over areas said to contain the above-specified minerals were practically *nil*, showing no lead, cobalt, or platinum, or its alloys, and only a very small percentage of copper.

The country-rock in the mine and vicinity is a highly altered volcanic tuff, cut by two porphyry dykes about 4 feet wide running diagonally through the tuff. In the vicinity of these dykes, which were injected after the forming of the tuff, a large amount of fracturing has taken place. In the fractures a good deal of iron oxides and carbonates have been deposited, and it is possible that the mineral was scraped out and some high assay results obtained. This is not a proper means of obtaining a fair tonnage average. In the upper workings there are segregations of copper ore in and near the contact of the pyroxenite and syenite rocks which give a fairly high ratio of platinum to copper-sulphide content, but these segregations are small and will need more development before the zone can be mined profitably.

If the money spent in driving the lower tunnel about 340 feet and on the partial installation of a 50-ton smelter and ore-bins had been used for legitimate development in and near the upper workings, the stockholders would have the satisfaction at least of knowing that their money had been spent in the right place. As it stands now their money is gone, there is no ore developed, and the confidence of the public is shattered.

Paulson District.

Terzic. A 25-foot open-cut was driven to tap the bottom of the old shaft about 10 feet below the surface. The lead was cleaned off and about 4 feet of ore exposed. Samples taken from the ore carried: Gold, trace; silver, 0.60 oz.; copper, 1.7 per cent.; lead, 2.5 per cent.; zinc, 5 per cent. The formation is an altered limestone in contact with greenstone, with tongues of granite intruded into the limestone. This is a good prospect and if a larger tonnage could be developed it might find a ready market.

Christina Lake.

Shamrock Group. This group of claims, consisting of the *Elmore*, *Congdon*, and *Shamrock*, is situated on Shamrock hill, about 1½ miles north-east of Christina lake. The mineralized area covers about four claims and constitutes outcrops of pyrrhotite interspersed with chalcopyrite. The country-rock is mainly greenstone, covered by remnants of limestone and intruded in places by olivine rocks. Along the line of contact between the limestone and greenstone a good deal of alteration has taken place, forming garnetite and epidote carrying copper and iron sulphides. These claims were prospected about twenty years ago, when Rossland camp was booming, and all the work seems to have been done on the pyrrhotite outcrops and little or no attention paid to the copper-contact minerals. A closer examination of these claims might be beneficial to the prospector.

Lightning Peak Camp.

Rampulo and Silver Lump.—The owner of these claims, B. Cortiana, did a considerable amount of work during the summer, driving a 400-foot tunnel and 27-foot upraise. Silver-sulphide ore was struck in this tunnel scattered through the limestone, carrying values of 157 oz. in silver and 0.35 oz. in gold to the ton. There are no definitely defined walls to the lead at present.

Lightning Peak.—This mine was leased to William Williams and a 400-foot drift commenced with the idea of developing the vein about 40 feet below the old winze. Some good ore is being encountered in segregations in a 4-foot lead. This ore has a high lead content. Numerous shipments have been made by the former lessees.

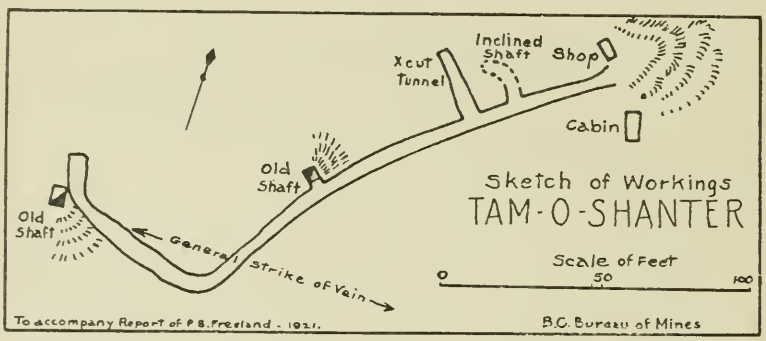
GREENWOOD MINING DIVISION.

A genuine endeavour was made by the prospectors and mining men of Greenwood to thoroughly exploit the country in the vicinity of the town for ore-bodies large enough to promote the welfare of the mining industry, which in the last few years has gradually declined. Some success was met with on the *Tam O'Shanter*, where Al. Morrison and Dan McGillis opened up a vein of gold, silver, and lead.

The operation of the *Providence* mine under the management of the owners was anything but a success, and the mine closed down after a few months, owing a considerable amount for labour, supplies, etc.

Providence. The owners of this property, C. Madden *et al.*, of Chicago, carried on operations for a short time during the summer and shipped 97 tons of gold-silver-lead ore to the smelter. Under the management of Al. Morrison and Dan McGillis, of Greenwood, the operation of this mine was a success, and the owners would do well to lease this property to them in the future. The presence of the secondary silver minerals in the lower levels is evidence of possible payable ore-bodies in the mine yet undeveloped.

A demand has been made by the bondholders for the payment of the principal, $50,000, and interest now due on the bond issue. The total, plus interest, notes, material, labour, etc., amounts to $85,024.48. If this amount is not immediately taken up by the stockholders, foreclosure proceedings will be taken.



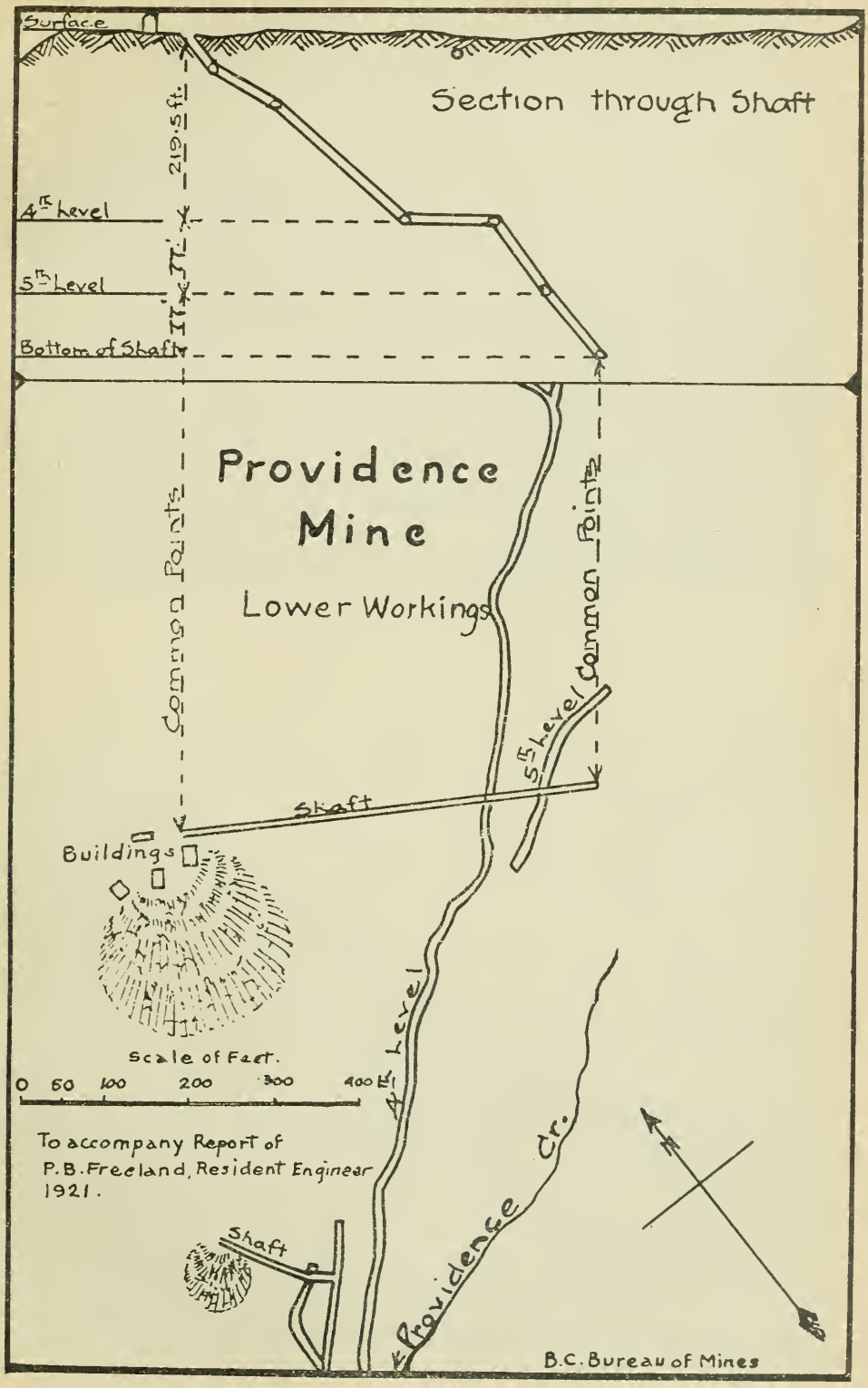
Vendella. This claim, located about a mile west of Anaconda, is owned by R. Pascoe, Bombini, *et al.*, of Anaconda, near Greenwood. An open-cut driven 25 feet on a contact of greenstone and limestone developed segregations of pyrite and chalcopyrite. Most of the mineralization occurred in the altered limestone. The gangue contained calcite, epidote, garnetite, with inclusions of black tourmaline containing specks of chalcopyrite and a trace of nickel. About 1,500 feet farther south boulders of the same material were found embedded in the wash.

The location of this claim, within easy reach of the Canadian Pacific Railway and high-power line, is excellent, and should a body of ore be developed the mining and transportation costs will be low. It is to be hoped that the owners will endeavour to prove the extension of this outcrop along the lines of contact by open-cuts and stripping.

A sample taken from the dump of the open-cut assayed: Gold, trace; silver, 0.80 oz.; copper, 2 per cent. Separate analyses proved the presence of nickel.

Last Chance. Some Greenwood interests examined this property, which had been operated several years ago, with the idea of opening up the old workings by means of a tunnel about 300 feet long. A thorough examination of the property was impossible on account of water in the shafts. Some high values were obtained from samples taken from the old dumps, but no average tonnage value could be arrived at. It is quite possible that there is some good ore left in the mine, but it would be extremely unwise for any one to drive a tunnel to tap the lower workings without first unwatering the shafts, exploring the lead, and thoroughly sampling it.

The ore sampled from the dump contained tetrahedrite, galena, zinc, and pyrites in a gangue of highly metamorphosed limestone. Values obtained were: Gold, 0.46 oz.; silver, 81.2 oz.; lead, 2 per cent.; zinc, 5 per cent.


Surface
Section through Shaft
219.5 ft.
4th Level
5th Level
Bottom of Shaft
11' 7"
Providence
Mine
Lower Workings
Common Points
Common Points
5th Level
Shaft
Buildings
Scale of Feet.
0 50 100 200 300 400
To accompany Report of
P.B. Freeland, Resident Engineer
1921.
4th Level
Providence Cr.
Shaft
B.C. Bureau of Mines

Helen. A lease was taken by Ole Lofstad on this old mine, which is situated within half a mile of Greenwood. Two tunnels were driven at lower elevations than the outcrop and a small quartz lead developed. Samples taken from the old shaft-workings gave results varying from a trace in gold to 1.50 oz.; 2.60 to 31 oz. in silver, and 7 to 26 per cent. lead to the ton. This property is well situated for transportation, power, etc.

Bonny Bell. This property is situated on the east side of Deadwood, adjoining the wagon-road. The lessee, O. Lofstad, sunk an inclined shaft on a quartz lead about 40 feet deep. The vein varied in width from 2 inches to 1 foot and carried silver-lead and pyrite. The quartz was only mineralized in small lenses, too far apart to make the ore a commercial one. Samples from these lenses gave a trace in gold, 35.5 oz. in silver, and 18 per cent. lead to the ton.

Crown Point. This old Crown-granted claim, situated on the south side of James creek, was leased by James Kerr, of Greenwood, and the old shaft cleaned out and a crosscut tunnel driven across the ore-body 10 feet. The ore occurs as segregations in the limestone and contains 0.10 oz. in gold and 6 oz. in silver to the ton, and 4 per cent. lead. Very little could be seen beyond the workings because the hillside was deeply covered with gravel and loam. It is possible that a fairly large body of low-grade ore could be developed in this shaft.

LONG LAKE CAMP.*

Roderick Dhu. Greenwood interests took an option on this claim, which is situated to the north of Jewel lake, on Roderick Dhu mountain. Very little work has been done on this claim since 1903, when a shaft was sunk about 75 feet and some ore stoped out to the surface for 100 feet to the south of the shaft. This shaft was filled with water at the time of examination, so nothing could be seen of the lead at depth. On the surface the quartz vein, varying from 2 inches to 1 foot in width, was mineralized with galena, pyrite, and limonite in the fractures, and carried values of 1.12 oz. in gold and 1.50 oz. in silver to the ton. This lead could be traced for about 500 feet north-east, where another shaft had been sunk 25 feet in the quartz. At this point the lead seemed to be more or less barren of values. Beyond the second shaft the vein was displaced by the intrusion of a pulaskite-porphyry dyke about 200 feet wide. The walls of the vein were gneiss.

Moonlight. This claim adjoins the *Roderick Dhu* on the north and is partially developed by open-cuts and shallow shafts on a quartz lead varying in width from 10 inches to 2 feet and traceable over a distance of 1,000 feet. The vein is not well mineralized, as far as the development shows, carrying values of 0.10 oz. in gold and 4 oz. in silver to the ton. The size and persistency of the vein warrant further exploitation.

Electric. The partial prospecting of this claim adjoining the *Roderick Dhu* to the south, was carried on by Greenwood interests in the autumn. One of the old open-cuts was cleaned out and a tunnel driven on the lead for 50 feet. For 12 feet in from the mouth of the open-cut and tunnel good ore was struck, averaging about 1 foot in width and carrying 1.68 oz. in gold, 22.9 oz. in silver, and 1.60 per cent. lead to the ton. Beyond this point the vein was crushed for about 12 feet, coming in again near the face and showing only quartz barren of values. This lead strikes north and south (mag.) and dips 64° to the east.

Ethiopia. G. Duhamel, of Greenwood, took a lease from the Government on this claim, situated on the south side of Jewel lake, and extended the old crosscut tunnel, as well as drifting on a lead to the east and west. This vein was cut about 60 feet from the mouth of the tunnel and showed bad fracturing and displacement as far as the face of the drift. Some galena and pyrite occurred in and along the fractures. On the surface beyond the end of the crosscut several open-cuts exposed a well-mineralized quartz lead carrying gold and silver. This vein dips flat into the hill and probably is beyond the end of the crosscut. Its strike coincides with that of the *Jewel* and may possibly be an extension.

WALLACE MOUNTAIN.

In spite of the many ups and downs in this camp during the last ten years, due chiefly to the extremely complicated system of faulting of the veins, the present owners of the *Bell*,

* The old name of Long lake has been changed by Geographic Board to Jewel lake, as the former name conflicted with Long lake at Vernon.

Westkettle River, between Beaverdell and Carmi.

Sally Mine, Greenwood M.D.

D. McIntosh and P. Crane, and Ed. Nordman, superintendent of the Wallace Mountain Mines, Limited, owners of the *Sally group*, are to be congratulated on the success of their efforts in keeping up the shipments of ore to the smelter. To-day the *Bell* and *Rob Roy* are in splendid condition and some very high-grade silver ore has been developed, giving expectation of a larger output for 1922.

Bell. Operations on this mine were continued throughout the year in spite of the lower price of silver and high cost of supplies. Development-work was kept well ahead of the stopes, which meant continual crosscutting on account of the extreme faulting of the ground. A compressor installed two years ago enabled the owners to use machine-drills, which greatly facilitated the exploration-work. A good shoot of very high-grade silver ore was struck late in the year; values up to 6,000 oz. in silver having been obtained. The total shipments were 107 tons of gold, silver, and lead ore.

Sally Group. This group consists of the *Sally* and *Rob Roy* claims and is owned by the Wallace Mountain Mines, Limited, of Penticton. Practically all the tonnage shipped and development-work was done from the *Rob Roy* claim, which adjoins the *Sally* on the north. An average of 11 men was employed and the total shipments amounted to 176 tons, with an average silver content of 323 oz. of silver to the ton. Development consisted of 477 feet of drifting, 496 feet of crosscutting, and 33 feet of upraising.

Highland Lass. This claim is situated a quarter of a mile to the north of the *Bell* mine, and is owned by I. Hallet, of Greenwood. An open-cut and tunnel 50 feet long was driven on the lead and about 10 tons of ore excavated. A fault near the face of the drift caused some trouble, but the lead was found again to the north of the fault. The lead consists of quartz and small particles of country-rock and strikes N. 70° E. (mag.), having a width of about 1 foot. A grab sample from the sorted ore gave 0.12 oz. in gold, and 959 oz. in silver to the ton, 24 per cent. lead, and 6 per cent. zinc. A good deal of fine carbonates were taken in this sample, which probably accounts for the exceedingly high percentage of silver. No shipments were made.

Napanee Group. After several years of diligent searching, C. G. Cummings, the owner of this group, discovered a vein of gold, silver, lead, and zinc ore. Although the wall-rock appears to be more or less shattered, there is every indication of the lead being in-place. The width of the vein is 5 inches and the strike N. 65° E. (mag.). A sample from the vein assayed 0.20 oz. in gold and 32 oz. in silver to the ton, 7 per cent. lead, and 14 per cent. zinc. The gangue was quartz. The zinc content is high, but may not prevail.

Highland Chief.—This claim is owned by Ed. Maloney, of Penticton. A high-grade silver-lead vein was uncovered and a tunnel driven in about 20 feet, when a fault was encountered. No more work was done to try and locate the lead, so the 2 tons of ore excavated was shipped to the smelter.

Kokomo.—This mine shipped 10 tons of high-grade silver-lead ore to the smelter at Trail.

Castor Frac.—Sutherland & Thompson, lessees, shipped 2 tons of silver-lead ore to the smelter.

Skylark Camp.

Surprise No. 3. This claim was again prospected by Joe Cunningham, of Greenwood, and a new lead of silver-lead discovered to the north-west of the old shaft. A vertical shaft was sunk 20 feet on the lead to a fault, which was followed down at a lesser angle for 10 feet and drifted on for about 35 feet. The vein from the surface down was badly broken and the ore, a silver-lead, and zinc occurred in small lenses. Other shallow shafts were sunk and the same condition found. It seems probable that the extreme faulting is a surface condition in the cover-rocks and that when some greater depth is attained the lead will be more consistent.

Boundary Falls.

White Star. The owner of this claim, Mark Christianson, of Boundary Falls, sunk an inclined shaft 40 feet deep on a quartz lead about 18 inches wide in the argillites. Small segregations of pyrite occurred in the vein carrying low values in gold and silver. The vein is well formed and outcrops persistently. A tunnel driven under the outcrop seems to be the best method of developing this vein and will be less expensive than sinking a shaft.

Texas. This claim lies to the north-east of the *Providence* group and is owned by Geo. Swanland, of Boundary Falls. Only a small amount of work had been done at the time of examination, consisting of a trench, small open-cuts, and a tunnel 15 feet long. The lead, striking north-east (mag.), composed of quartz, was only about 2 inches wide, showing small stains of oxide of iron. The country-rock was a greenstone, intruded in the vicinity of the workings by alkali-syenite dykes. A sample of quartz gave a trace in gold and 0.70 oz. in silver to the ton.

Deadwood Camp.

Golconda. Operations were first commenced on this claim in 1907 by Quebec interests and a shaft sunk 45 feet, open-cuts 100 feet, and a crosscut tunnel 690 feet. The old shaft was sunk on a pyrrhotite-capping, which contained values on the surface of 0.78 oz. in gold and 0.50 oz. silver to the ton. The ore, if any, at the bottom of the shaft was not explored because of water. The open-cut showed extensive mineralization near the shaft. The long crosscut tunnel was driven with the intention of prospecting the area about 200 feet below the open-cut. Evidently those interested ran short of capital before the venture was proved. E. A. Wanke, the present owner, drove another crosscut tunnel 110 feet long and 190 feet below the shaft, farther to the north than the old tunnel. About 200 feet more will have to be driven before the tunnel is vertically under the shaft.

The country-rock surrounding the workings is a greenstone, capped by altered volcanic tuffs. It seems advisable before doing any more development-work to unwater the shaft and find out the value and size of the ore-body in the bottom.

Rock Creek.

Riverside. Paul Nelson and Oli Lofstad *et al.*, of Oroville, Wash., and Greenwood, leased this claim from the Government and drove a crosscut tunnel 60 feet, another 40 feet, and 15 feet of upraise, besides building log houses and cook-shack. In former years, when transportation was difficult, several hundred tons of ore was mined, sorted, and shipped to the smelter, averaging about $50 to the ton. Average samples taken over 3 feet of lead-matter near the collar of the inclined shaft gave 0.08 to 0.12 oz. in gold, 29.5 to 34 oz. in silver, 3.5 per cent. lead, and 7 per cent. zinc to the ton. It was impossible to take any samples lower down the shaft because of water.

This zone near the collar of the shaft was highly oxidized and may not be representative of the ore lower in the workings. Only when the shaft is unwatered can a proper estimate be made of the value of the mine. The crosscut tunnel, now being extended, will develop the zone near the bottom of the shaft in another 40 feet. The close proximity of the railway, river, and high-power electric line greatly adds to the possibilities of operating the mine profitably.

Summit Camp.

Blue Bell. This property, formerly owned by W. Shaw and Jack Dorsey, is now being prospected by Mike Blufontein, of Coltern. This old Crown-granted claim is situated about 1,500 feet north-east of the *Emma* mine and within half a mile of the Greenwood–Grand Forks wagon-road. The old shaft, 110 feet deep, was unwatered and retimbered and a drift driven 25 feet north, 60 feet down from the collar. The mineralized zone occurs in the limestone near its contact with greenstone and contains small lenses of chalcopyrite and pyrite in epidote and garnetite, averaging about 3 feet in width. To the south of the shaft an alkali-syenite dyke cuts the formation and probably disturbs the mineral-zone in that direction. This is a good formation for the deposition of copper ores and further development to the north seems worth while.

Lightning Peak Camp.

The developments in this camp are progressing favourably in spite of the short season and lack of capital by most of the claim-owners. A new discovery on the *Potosi* group is an added interest, bearing out the theory that the mineralized area follows around the foot of Lightning peak, where the igneous rocks are in contact with the sedimentaries. Future development of this camp should be watched carefully. If the vein on the *Waterloo* and *Potosi* claims which have the same strike, can be connected by development-pits the owners should have no trouble in interesting capital.

Waterloo. Assessment-work was done on the tunnel below the blacksmith's shop and a crosscut tunnel driven into the foot-wall, which developed a foot of ore hitherto undiscovered. In a formation of this character, limestone intruded by granite, the owners would do well to crosscut occasionally a few feet into both walls. This is a silver-lead property from which very high-grade ores were shipped from the surface. The lower zone seems to assay from $30 to $100 in silver and lead, which is too low grade to ship.

Potosi Group. This group of claims consists of the *Potosi*, *Potosi No. 4*, and *Silver Spot No. 4*. The owners, Jim Graham and Nelson, of Greenwood, turned the creek in the vicinity of the claims and sluiced off the gravel-wash, which was about 10 feet deep, resulting in the exposure of a vein about 8 feet wide in the limestone. The ore is silver, galena, and tetrahedrite in a gangue of calcite. This vein has the same strike as the *Waterloo* and possibly lies in the same fractured zone. The continuance of this lead will have to be proved by pits and open-cuts, which will take time as the wash is deep.

Lumpy.—A 30-foot tunnel was driven on this property by Walter Johnstone. Some good silver sulphides were encountered scattered through the limestone, but no definite lead developed. This claim lies in the same zone as the *Potosi*.

BOUNDARY DISTRICT.

GREENWOOD MINING DIVISION.

REPORT BY W. R. DEWDNEY, GOLD COMMISSIONER.

I have the honour to submit my annual report on mining operations in the Greenwood Mining Division for the year 1921.

NEAR GREENWOOD.

Providence.—This mine shipped 97 tons of first- and second-class ore to the Trail smelter during the year. The owners, the Providence Mining Company, Limited, have commenced to extend the development-work on the property.

Tam O'Shanter.—Owned by A. J. Morrison and Dan McGillis. The ore carries silver and gold. Development consisted of drifting 300 feet to strike the lead at depth and raising 75 feet to connect with a shaft. Ore has been struck at the bottom of the shaft where it meets the raise. A shipment is expected to be made at an early date. Indications are that this mine will soon be on the shipping-list.

Vendella.—The work done on this property during the year consisted of an inclined shaft 25 feet long; another shaft 30 feet deep; open-cut 20 feet long, 10 feet wide, and 15 feet high. The ore carries copper and gold. The future development of this property is looked forward to with great interest, as the work performed so far is most encouraging to the owners, Samuel Bombini *et al.* The Department of Mines has constructed a good trail to the mine and it is proposed to soon ship some ore for a trial test. About 80 tons of ore is on the dump ready for shipment.

WALLACE MOUNTAIN, NEAR BEAVERDELL.

Bell.—Operated by Duncan McIntosh and Pat Crane. Some 106½ tons of ore (mainly silver) was shipped to the Trail smelter during the year, containing 32,456 oz. silver, the total returns being $21,691. The average number of men employed was six. Two cars of ore are now ready for shipment. The development consisted of drifting 888 feet and raising 250 feet.

Wellington.—Sutherland & Thompson shipped 8 tons of ore to the Trail smelter that ran 247 oz. silver to the ton. Twenty-five feet of drifting was done on the lead and some overhead stoping.

Castor Fractional.—Sutherland & MacPhee shipped 2 tons of silver ore to the Trail smelter for treatment. They drifted on the lead 60 feet.

Revenge Group.—The owner, G. M. Barrett, opened up a crosscut on the lead 10 feet long and drove a tunnel 40 feet. He is getting out some very fine ore, but did not ship to the smelter during the year. An ore-bin 16 by 24 feet was built on the property.

Kokomo Fractional.—A 70-foot tunnel was driven on the claim and a shaft sunk 45 feet. Ten tons of good ore was shipped to the Trail smelter. The ore carries silver and lead.

Highland Lass.—This claim adjoins the *Bell* and is owned by I. H. Hallett and R. Smailes. The ore contains silver and gold, being similar to that of the *Bell*. J. McKellar has an option on the Smailes' half-interest. There is about 15 tons of ore on the dump ready for shipment.

Dayton Fractional and Doris Fractional.—The usual assessment-work was done on these claims with good results. On the *Dayton Fractional* a body of low-grade copper ore was uncovered 10 feet wide and running about $4.50 to the ton, all values. Not enough development-work has been done to determine the extent of the ore-body.

Riverside Group.—Situated about 3 miles above Rock Creek, on the east side of Kettle river, and owned by the Jack Paul Mining Company, with head office at Spokane, Wash. Two men were employed during the year. The ore carries silver, gold, and lead. F. Keffer, mining engineer, of Spokane, inspected this property recently, with the result that the company is going to drive a tunnel and employ more men.

Surprise No. 3.—Situated in Skylark camp and leased to Joseph Cunningham and Sartoine. The development consisted of a tunnel driven 60 feet long, sinking 25 feet, drifting 50 feet, and

an open-cut 100 feet long. A 2-foot vein was exposed, averaging about $100 to the ton, I am informed by Mr. Cunningham. The ore carries gold, silver, and lead.

Sally Group.—Average number of miners employed, 8; average number of others employed, 4.

Shipments: One car to the Northport smelter, 38.5 tons; four cars to the Trail smelter, 138 tons; total, 176.5 tons.

Values paid for: Gold, 1.161 oz.; silver, 56,284.09 oz.; lead, 23,685 lb.

Development: Drifting, 477 feet; crosscutting, 496 feet; raising, 33 feet.

Practically all the development-work was done on the *Rob Roy* and all the ore shipped was taken from this claim. The mine is in splendid condition, and the owners, the Wallace Mountain Mines, Limited, anticipate a larger output in 1922.

Office Statistics—Greenwood Mining Division.

Free miners' certificates	136
Locations (quartz)	47
Locations (placer)	5
Rerecords (placer)	4
Certificates of work	136
Leases of reverted mineral claims	17
Bills of sale	14
Permits to search	1
Leaves of absence	3
Powers of attorney	4
Certificates of improvements	1
Filings	13

GRAND FORKS MINING DIVISION.

Report by S. R. Almond, Gold Commissioner.

I have the honour to submit the annual return of the office statistics of the Grand Forks Mining Division for the year 1921, as below.

As the mining industry in this Division will be covered in the report of the Resident Mining Engineer for the Southern District (No. 4), there will be no need of a report on this head from the Gold Commissioner.

Office Statistics—Grand Forks Mining Division.

Free miners' certificates	85
Locations	25
Certificates of work	85
Bills of sale	11
Filings	6
Certificates of improvements	1
Crown grants	1
Leases of reverted claims	6

OSOYOOS MINING DIVISION.

Report by Jas. R. Brown, Gold Commissioner, Fairview.

I have the honour to submit the annual report on mining operations in this district for the year 1921.

I regret to say that there has been no improvement in mining operations during the year; rather the reverse.

Office Statistics—Osoyoos Mining Division.

Locations	84
Certificates of work	106
Conveyances	10
Free miners' certificates	171

SIMILKAMEEN MINING DIVISION.

REPORT BY HUGH HUNTER, GOLD COMMISSIONER.

I have the honour to forward the mining statistics of this office for the year 1921.

OFFICE STATISTICS—SIMILKAMEEN MINING DIVISION.

Free miners' certificates	185
Location records	73
Certificates of work	214
Bills of sale	9
Certificates of improvements	15
Abandonments	1
Liens	1
Leases (mineral claims)	5
Leases (placer claims)	9
Powers of attorney	5
Record of placer claims	9
Mining receipts, general	$2,450 05

CENTRAL DISTRICT (No. 3).

VERNON AND ASHCROFT MINING DIVISIONS.

(Note.—The Resident Mining Engineer for these Divisions having been seriously ill and having since died, P. B. Freeland has made the following reports on certain properties in the Divisions.)

VERNON MINING DIVISION.

Properties examined by Philip B. Freeland, District No. 4.

Queen Group. This group, consisting of the *Queen* and *St. Claire* claims, is situated about 8 miles north-west of Vernon, on the west side of Okanagan lake, and is owned by McIntyre & Mabee, of Penticton and Kelowna. A good wagon-road has been built to the foot of the hill on which the claims lie. Development-work consists of numerous open-cuts, several shallow shafts from 10 to 20 feet deep, and trenching. Nearly all the work has been done where there is an indication of pyrrhotite. Most of the mineralization occurs in a highly metamorphosed sedimentary which has been fractured by the intrusion of a porphyry dyke outcropping about half a mile to the south from the workings. A good deal of copper-carbonate stain can be seen in the fractures on the surface and at the bottom of the shafts and open-cuts small lenses of chalcopyrite occur. The general strike of the fractures is north-east and south-west and covers an area of about 1,500 feet square. A general assay gave a trace in gold and silver and 1.70 per cent. copper. The gangue was silica, epidote, and some calcite. Needs more surface development before capital can be interested.

Falcon. Very little can be said about the possibilities of this claim because the examination was made when there was 6 inches of snow on the ground. The situation of the claim, about 2 miles north-west of Vernon and within three-quarters of a mile from a wagon-road, renders transportation easy. A shaft which had been sunk 40 feet was half filled with water and the open-cuts with snow. In the shaft a quartz lead varying from 6 to 14 inches was developed, showing segregations of arsenical iron chiefly near the collar. The strike of the lead is north and south (mag.) and the dip about 20° to the west.

A sample taken across the lead 18 feet below the collar of the shaft gave a trace of gold and silver to the ton. Another sample of white quartz, slightly oxidized in the fractures, gave 0.12 oz. in gold and 0.08 oz. in silver to the ton. The arsenical iron, with very little quartz present, gave 0.82 oz. in gold and 0.70 oz. in silver to the ton. The results of these samples clearly show that the values are in the iron or its oxides, and the future of the claim rests on the possibility of developing more of this mineral. Open-cuts to the north showed a continuance of the quartz.

Monashee, Morning Sun, McIntyre Group. A gentleman named F. S. Munson formed the Progressive Mining Company, of Vernon, with the intention of selling stock to the people of Vernon and vicinity and developing the above claims, situated about 48 miles east of Vernon. Practically all those who were working in connection with the property were asked to take stock in the venture as part payment for their labour. Work commenced in the autumn and log cabins built for bunk and cooking purposes on the *Morning Sun* claim. After stripping a quartz lead from 4 to 10 feet wide for about 100 feet a crosscut tunnel was started 125 feet below the outcrop and driven 40 feet, at the time of examination, in a highly altered volcanic tuff, slightly mineralized with pyritohedrons of iron. A sample across the quartz lead in one place gave 0.59 oz. in gold and 0.80 oz. in silver to the ton. The volcanic tuff gave 0.02 oz. in gold and 0.10 oz. in silver.

On the *McIntyre* claim, which adjoins the *Morning Sun*, the old open-cuts and tunnels have been cleaned out. Samples from the open-cuts and lead in the tunnels averaged 0.06 oz. in gold and 0.20 oz. in silver, which shows them to be too low grade at present for operation.

The mouth of the main tunnel on the *Monashee* claim was cleaned out and retimbered. This tunnel was driven 375 feet on the lead many years ago. Samples taken on the south side of the fault, over 150 feet of quartz lead (crushed) averaging 1 foot in width, gave an average

of $7 in gold to the ton. Beyond the fault the lead seemed to be barren as far as development had gone. An old stamp-mill built to concentrate the ore many years ago was in a delapidated condition. Two feet of snow on the ground prohibited a proper examination and little can be said of the possible future of this venture.

White Elephant, Early Sun, Lora Bell, Hill Top.

These claims are situated about 2 miles from Okanagan lake, on the west side, above Ewing's Landing, and are owned by Archie Clarke, Mrs. Clarke, Mrs. Saunders, and L. L. Stewart, of Okanagan Centre and Vernon. The discovery of a quartz-outcrop about 50 feet wide, containing free gold and bismuth, by A. Clarke created a good deal of excitement in local circles. The surface was stripped and a shallow shaft about 7 feet deep and several open-cuts were excavated. In the shaft the quartz was crushed and oxidized in the fractures, showing occasional films of free gold and generally in contact with bismuth. Samples of the quartz carrying the free gold naturally gave very high results, but they were not a true average of possible tonnage. Two samples taken across the side of the shaft where the mineralization was heaviest gave about $16 in gold to the ton, which seems to be more reliable. An open-cut 20 feet to the south of the shaft uncovered a body of pyrrhotite which assayed only a trace in gold. Other open-cuts carried only low values.

The presence of free gold in the quartz makes the property quite attractive, but before installing any plant for treatment of this ore it should be remembered that the past history of the vicinity records high-grade quartz bearing free gold to be of a "pockety" nature, which makes it advisable to develop the ore-body extensively first. The vicinity of the outcrop was covered with a heavy wash, and with so little development done even the strike of the ore was problematical at the time of examination.

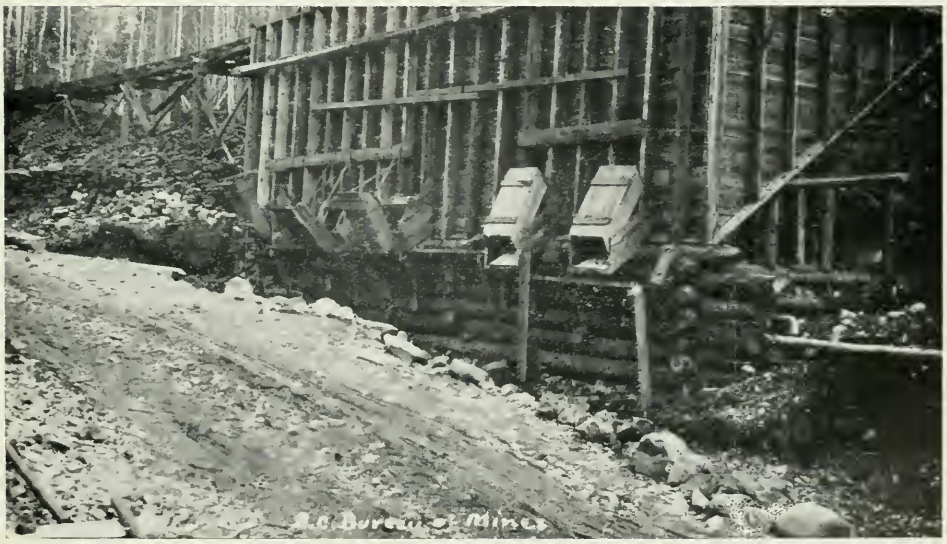
The country-rock, where seen, was badly weathered, but resembled granodiorite. On the highest part of the hill remnants of limestone were found and above the outcrop to the south-west some alkali-syenite float. The location of the claim is good and transportation, by gravity to Okanagan lake, easy. There is plenty of timber for all purposes, but water is scarce.

ASHCROFT MINING DIVISION.

Kanaka Placers.

Kanaka bar is situated on the Kanaka Indian Reserve on the Fraser river about 9 miles south of Lytton, on the Canadian Pacific Railway. On the west side of the river the railway cuts along the side of a high gravel-bank. About 100 feet below the track a good deal of gold was placered in 1840. In and above these old grounds new interest has been taken by D. McKinnon *et al.*, of Grand Forks and Vancouver. Near the bottom of the bank and also on a false bed-rock good colours were obtained by panning, also a considerable amount of black sand carrying gold. It is the intention of the owners to try and save the values by special concentration, because the gold seems to be too fine for the ordinary methods. There are several million yards of gravel in the bank, and if good enough values can be obtained per yard the venture may be profitable.

Chu Chua Coal Co.—Portal.



Chu Chua Coal Co.—Bunkers.

LILLOOET DISTRICT.

LILLOOET MINING DIVISION.

Report by John Dunlop, Gold Commissioner.

I have the honour to submit the annual report on mining operations in the Lillooet Mining Division for the year ending December 31st, 1921.

Lode-mining in this Division being principally confined to the production of gold, I regret to report that the recovery of bullion during the past season has almost reached the vanishing-point. That disappointing statement in nowise detracts from the actual merits of the properties so operated and active, but emphasizes the continued unstable conditions and the inability of the gold-producing camp to continue production.

The *Pioneer* mine on Cadwallader creek, after being closed down about twelve months, was reopened by a Vancouver syndicate in the early part of the season. The work performed consisted of repairing tunnels and old workings and also the installation of a cyanide plant. Breakages in machinery and other unforeseen contingencies occurred at intervals, thus hindering the work and hampering the management.

At the *Lorne* mine, beyond work of an exploratory character and the extending of tunnels, no attempt was made to operate the stamp-mill on the premises.

At the *Wayside* and *Ida May* mines, and also the mineral locations on McGillivray creek, development-work was carried on and the veins extended, with a view to having those properties in a position favourable to successful operation when conditions improve.

During the past eighteen months considerable attention has been directed to the acquiring of placer-mining ground on the lower and upper reaches of Bridge river. On the former the work, consisting of wing-dams and sluicing, has been carried on with the object of testing the bed of the river. I understand that a company is formed to take over the greater part of the ground leased and to operate in a miner-like manner. So far the work done has been carefully directed.

Backed by English capital, the company owning the placer-mining leases in and around the Horseshoe Bend of the Bridge river has again resumed activity and has installed some of the latest mining machinery.

Office Statistics—Lillooet Mining Division.

Free miners' certificates issued	206
Mineral claims recorded	142
Certificates of work recorded	170
Placer-mining claims recorded and rerecorded	3
Placer-mining leases in force	59
Certificates of work, "Placer-mining Act"	54
Transfers and agreements recorded	77
Leases granted, forfeited mineral claims	1

Revenue.

Free miners' certificates	$1,066 25
Mining receipts, general	3,716 45
Tax, Crown-granted mineral claims	558 50
Crown grants, mineral claims, fees	225 00
Total	$5,566 20

CLINTON MINING DIVISION.

REPORT BY G. MILBURN, GOLD COMMISSIONER.

I have the honour to submit the annual report of the Clinton Mining Division for the year ending December 31st, 1921.

A development of great interest, not only to the district but possibly of great importance to the whole Province, is the prospect of the ground in the neighbourhood of E. J. Taylor's *Windfall* mineral claim, situate in the Taseko or Whitewater River country, turning out to be as good as the claim in question is said to be. There are apparently three routes by which this territory may be reached. From Lillooet over snow-clad summits is the shortest way, but I believe it is almost, if not quite, impracticable until late in the spring. Two locators travelled this route back to Lillooet late in December and as a result of their work recorded some fifty claims.

The Public Works Department sent J. K. More, Road Engineer, to locate a road in continuation of one already built to a point within about 60 miles of the discovery. He succeeded in doing so and found that a wagon-road with reasonable grades can be made at a comparatively moderate cost. This road would be a continuation of the Chilcotin main road, which passes through Williams Lake, on the Pacific Great Eastern Railway. In addition to the two routes mentioned is another from Clinton by good roads through Kelly lake, Canoe creek, and Gang Ranch to a point some miles beyond Big creek, and thence by an existing pack-trail to the scene of the discovery.

I am informed that the valley in which the discovery was made by Mr. Taylor is some 25 miles long. Mr. More brought out samples of sand containing fine gold.

During the year of this report there have been about 150 mineral claims located in this portion of the Division and recorded in my office, most of them during the fall months. These recordings have been made in fair-sized blocks, the staking having been done by a few, acting as agents. About 100 more claims were staked in December and recorded in January, 1922.

The situation in regard to claims covering hydromagnesite-deposits is nearly the same as it was when I reported last year. On quite a number of claims payment of $100 in lieu of work has been recorded to keep the claims alive. These properties are unquestionably valuable and there is little doubt that a market will develop in time. Hydromagnesite is being shipped by way of the Pacific Great Eastern Railway at the siding at Exeter from the *White Empress* mineral claim, formerly owned by A. E. Carew-Gibson, but now in the hands of the Pacific Roofing Company, Limited, of Vancouver. Several large motor-trucks are being used to carry the commodity from the claim to the railway, and while I have no exact information I am informed that several car-loads have been shipped.

A large field of hydromagnesite lying north from Exeter for several miles as far as Township 12, Lillooet District, formerly staked in the year 1919, was restaked during June and the whole property now stands in the name of Kenneth Munro, of Vancouver. So far as I know, no work has been done on these claims, either to investigate or by way of assessment-work. I am informed that negotiations, which are likely to be successful, for the sale of the hydromagnesite-deposit on the Dougherty Ranch at Clinton are now going on. The Meadow Lake deposit referred to in previous reports, which is the largest and best discovered in this district, has not yet developed into a shipping proposition as was thought possible last year.

A good deal of activity has arisen in connection with the soda lakes and deposits. The Lillooet Soda Syndicate, Limited, with headquarters at Vancouver, employed a number of men under the direction of F. Silverton on their properties, the *Goodenough* and *Last Chance* Crown-granted claims, situate about 12 miles west from Chasm, north of Clinton. A considerable quantity of carbonate of soda was shipped, a ready market being found for all that can be extracted. It is expected that a much larger quantity will be shipped next year and preparations have been made to this end. Motor-trucks are employed to take the soda from the claims to the railway, a fair road being available for this traffic.

The Soda Mining and Products Company, Limited, holding a large number of Crown-granted mineral claims and ground covered by mineral records, has done little in the way of development or extraction this year, but, I understand, intend to put in a modern calciner when ready.

There are various other soda lakes chiefly held by the locators, who are awaiting an opportunity to turn them over to concerns who are looking for industrial chemicals. The

summer season was again dry and many of the lakes which were well covered with water now have soda crystals exposed.

A large deposit of gypsum near the railway at Kelly lake has been opened up by Leonard Burley and associates, and several car-loads have been sacked and shipped to Vancouver, in the vicinity of which place a market is being worked up among the agriculturists. The deposit in question is so situated that the gypsum can be put on the cars with the minimum of handling. A chute has been erected to a platform alongside the railway and the loading is done from that.

The magnesium-sulphate deposit has not been worked during the year, neither has any of that collected and stored on the shores of the lake been shipped. I am uninformed as to the intentions of the owners for the future. While a very considerable quantity has been taken from the lake, there is a vast amount still available and awaiting an accessible market.

Some prospecting has been carried on on the claims lying about 6 miles south of Clinton and assessment-work was recorded on a few of them. The results of the season's work do not appear to have been very encouraging, as attention was diverted to ground farther south in the vicinity of Maiden creek. There several claims were located and assays of the samples taken are regarded very optimistically by the owners, the returns showing the presence of gold, silver, and copper.

Placer-mining is much about the same as it has been for several years past. Although there are fewer placer claims in existence, the quantity of gold recovered is a little greater than last year, a total of approximately 250 oz. having been sent to the assay office. The whole of this gold was taken from the First North fork of Watson Bar creek. One placer claim was staked on Churn creek, but the locator informed me that the gold-bearing sands were very limited in area and the best he hoped for was a return a little exceeding wages.

One creek lease was issued during the year and there are now two mining leases on record. Both of these are on a branch of Watson Bar creek and I understand the auriferous gravels are fairly well covered. Development-work on both these leases has been done during the season and it is hoped gold will be recovered shortly.

The year was a fairly busy one in the matter of office records. Exactly twice as many mineral claims were recorded as compared with the year before. Certificates of work issued were a few less, but the number of bills of sale, etc., were very much greater. Revenue from free miners' certificates and from mining receipts (general) exceeded collections for the year 1920.

Office Statistics—Clinton Mining Division.

Free miners' certificates	101
Mineral claims recorded	238
Certificates of work issued	101
Placer claims recorded	4
Placer claims rerecorded	3
Placer leases in existence	2
Placer leases issued	1
Bills of sale, etc.	90

Revenue.

Free miners' certificates	$ 396 75
Mining receipts (general)	2,931 15
Total	$3,327 90

YALE DISTRICT.

NICOLA MINING DIVISON.

REPORT BY J. A. MURCHISON, MINING RECORDER.

I have the honour to submit herewith the annual report and office statisitcs of the Nicola Mining Division for the year ending December 31st, 1921.

Owing to the high cost of labour and the low price of metals, mining has not been vigorously prosecuted during the year 1921.

OFFICE STATISTICS—NICOLA MINING DIVISION.

Mineral claims recorded	43
Placer claims recorded	20
Free miners' certificates	128
Certificates of work	106
Bills of sale	10

VERNON MINING DIVISION.

REPORT BY L. NORRIS, GOLD COMMISSIONER.

I have the honour to submit the following annual report on the mining industry in the Vernon Mining Division for the year 1921:—

On March 30th last Archie Clark staked the *White Elephant* mineral claim on Shorts creek, on the west side of Okanagan lake, about 9 miles south-west from Okanagan Landing. Some very rich specimens of free-milling gold have been taken from it. It is now, I understand, under bond to American capitalists.

Some new claims were staked on Monashee mountain last summer. There was also considerable activity in a quiet way among the mines there.

On Cherry creek twelve placer leases were staked by the Cherry Creek Hydraulic, Limited. This company now controls fourteen leases on this creek. The construction of the ditch is pretty well advanced and the company will be able to commence sluicing as soon as the spring opens up.

There were also four placer leases staked on Whiteman creek by E. A. Keeley, H. T. Ross, S. Mercer, and H. A. Street, of Vancouver.

OFFICE STATISTICS—VERNON MINING DIVISION.

Free miners' certificates	188
Mineral claims recorded	54
Certificates of work	8
Bills of sale	9
Conveyances	6
Placer leases	16

YALE MINING DIVISION.

REPORT BY H. BEECH, MINING RECORDER.

I have the honour to submit the annual mining report and office statistics for the year ending December 31st, 1921.

PLACER-MINING.

Placer claims on Siwash creek which were abandoned have again been restaked and active work has been carried on throughout the summer.

Lode-mining.

Development-work has proceeded steadily on most of the claims in the Yale Mining Division.

The *Emancipation* mine, bonded by the Liberator Mining Company, has opened up a large body of high-grade milling-ore above the old workings, and the company has employed from twenty to thirty men the last year putting in a cable-tramway and ore-bunkers. A stamp-mill is in course of erection.

The Spidel Peak properties in the same locality have been bonded and are being thoroughly prospected.

The *Eureka* group, 10 miles west of Hope, is being put into shape to prove the known ore-bodies.

The *Gisby* group at Keefers is being developed by the British Columbia Silica and Talc Company, of Vancouver, and will soon be in shape for production.

Office Statistics—Yale Mining Division.

Free miners' certificates issued	148
Mineral claims recorded	75
Certificates of work issued	181
Bills of sale recorded	12

ASHCROFT MINING DIVISION.

Report by J. S. Alexander, Mining Recorder.

I have the honour to submit my annual report as Mining Recorder for the Ashcroft Mining Division for the year 1921.

A number of placer claims were staked in the vicinity of Spences Bridge, where a strike was made in March, and work is still progressing on these claims.

The annual assessment-work has been done on the majority of all the old claims.

A comprehensive report on mining conditions in this Division will, I understand, be made by the Resident Mining Engineer.

Office Statistics—Ashcroft Mining Division.

Mineral claims recorded	94
Certificates of work issued	89
Certificates of improvements	8
Placer claims recorded	20
Placer-mining leases granted	2
Powers of attorney recorded (placer)	10
Bills of sale recorded (placer)	6
Lay-overs granted (placer)	1
Leaves of absence granted (placer)	1

KAMLOOPS MINING DIVISION.

Report by E. Fisher, Gold Commissioner.

I have the honour to submit my annual report for the Kamloops Mining Division for the year ending December 31st, 1921.

With the exception of assessment-work, which has been well kept up, quartz-mining in this Division during the past year has again been practically at a standstill. The most important work has been done on the *Windpass* group, where a shaft 7 by 16 feet has been sunk to a depth of about 40 feet and a drift 7 by 10 feet run for a distance of 16 feet. The vein here is a replacement of the diorite country-rock by magnetite, feldspar, and a little calcite, with some free gold and gold telluride. The width of the vein has not yet been determined, as it is wider

than the present workings and will require crosscutting to prove the full width. Some 1,800 lb. of this ore shipped to the Trail smelter carried gold at the rate of $438 a ton. The vein looks strong and contains 3 to 4 feet of good ore, besides the low-grade stuff. Between 300 and 400 sacks of second-grade ore are at present being brought to Chu Chua for shipment to Trail; the values are practically all in gold, most of which is free. The difficulty at present with this property is its accessibility, but if the values continue as at present it would warrant the expenditure of the necessary capital to overcome this difficulty.

No mining has been done at the *Iron Mask* during the past year, but a force of men have been kept employed completing the overhauling of equipment and the installation of the pipe-line from the Thompson river to the mine. This latter, I understand, is now complete and working satisfactorily, and with an improvement in the price of copper it is expected that the mine will shortly be in active operation again.

There has been considerable activity in placer-mining, leases being taken up on 3-Mile creek, Louis creek, and North Thompson river. On 3-Mile creek the Jumbo Mining Company has built a flume from the dam 850 feet long by 2 by 1, with 200 feet of sluice-boxes. The company ground-sluiced a cut 100 feet long, 25 feet wide, and 7 feet deep, also sank a shaft 4 by 6 feet, 46 feet deep, and timbered it, but owing to water it was unable with the present equipment to reach bed-rock, but work will be continued next season.

Milton Roper has driven a tunnel 55 by 4 by 6 feet, sunk several prospect-holes, and made several open-cuts on the Roper lease. Mr. Cardon put in a line of sluice-boxes on his lease and with Mr. Roper sluiced a big open-cut. This showed good values in fine gold and work will be resumed in the spring.

MacKay & Boggs worked all the summer on their property, and on the Stevens & Mayville property a shaft was sunk and timbered 14 feet and several prospect-holes dug, in which good values were found. As a result of the showings on this creek it is anticipated there will be greater activity next season.

On Louis creek J. W. Smith built a considerable amount of flume in preparation for next season's work.

OFFICE STATISTICS—KAMLOOPS MINING DIVISION.

Free miners' certificates	344
Mineral claims recorded	76
Placer claims recorded	6
Placer leases	13
Certificates of work (mineral)	183
Certificates of work (placer)	6
Bills of sale	28
Powers of attorney	15
Leaves of absence	11
Permissions to relocate	2
Mining receipts	$4,025.55

WESTERN DISTRICT (No. 6).

Report by Wm. M. Brewer, Resident Engineer.

INTRODUCTION.

The Western Mineral Survey District (No. 6) includes the seven most westerly Mining Divisions in the Province. These are Alberni, Clayoquot, Quatsino, Victoria, and Nanaimo on Vancouver and adjacent islands, and New Westminster and Vancouver on the Mainland.

As an introductory to the following annual report on the Western Mineral Survey District, the writer desires to express his appreciation for the several courtesies that have been extended to him during the past year, and to heartily thank each and every one of the men connected with the mining industry in his district with whom he has had business, as well as those from other districts whom he has met, for their many kindnesses and the ready assistance that have been universally extended to him.

TALKS TO PROSPECTORS.

Early in the past year the Hon. Wm. Sloan, Minister of Mines, decided on inaugurating a policy heretofore not followed in any of the Provinces in the Dominion or in any of the mining centres in the United States. In this connection he instructed the Resident Mining Engineer in each of the Mineral Survey Districts to prepare and deliver a course of addresses or talks to prospectors of an instructive and informative character on the rudiments of chemistry, mineralogy, and geology. The preparation and delivery of such talks was undertaken by the writer after having completed the annual report on his district. Between February 21st and April 22nd four talks were given in Victoria, Duncan, Nanaimo, and Alberni, and one in Cumberland, which were well received by audiences that increased in numbers.

After completing this work and owing to the serious illness of R. W. Thomson, Resident Engineer of the Central District, the writer was requested to visit Hope to carry out some examinations with regard to aiding prospectors in that section by constructing necessary roads and trails under the "Mines Development Act, 1916."

"IRON-ORE SUPPLY ACT, 1919."

From May 15th to June 1st mining, sacking, and shipping of about 22 tons of magnetite ore for experimental purposes from the *Lake* mine, on the west coast of Texada island, to Thos. Summerson & Sons, Limited, of Darlington, England, was carried out in accordance with the provisions of the "Iron-ore Supply Act, 1919." The shipment was made on the steamship "Spectator," which sailed from Vancouver about June 1st. Later in the year a smaller shipment of similar ore was made to W. Perrins, of Nanaimo.

EXAMINATION OF MINERAL CLAIMS.

Twenty-six groups of mineral claims were examined during the past year, reports on which will be found later in this report. The carrying-out of this work necessitated visiting Tatlayoko lake and Klinaklini river, in the northerly part of the Nanaimo Mining Division, on the Mainland; Texada, Lasqueti, and Quadra islands, Jump river, and upper Campbell lake, in the Nanaimo Mining Division; Indian and Stawamus rivers and Nelson island, in the Vancouver Mining Division; Koksilah and Leech rivers and Cowichan lake, in the Victoria Mining Division; also points on the west coast of Vancouver island, in the Alberni, Clayoquot, and Quatsino Mining Divisions.

DISASTERS.

During 1921 this district has been visited by two serious disasters, both of which occurred at the Britannia Mining and Smelting Company's beach camp, which, in addition to the depressed state of the copper market, are responsible for the fact that the production from the metalliferous mines of this district has been comparatively small. The production has been confined entirely to the shipment of 47,385 tons of copper ore from the *Britannia* mine, being partly the contents

of a storage-dump at Britannia Beach which had to be removed from the site selected for the new concentrating plant. This ore produced about 646 oz. gold, 7,943 oz. of silver, and nearly 1,411,376 lb. copper

The first disaster occurred on March 19th, 1921, when the concentrating-mill of the *Britannia* mine at Britannia Beach, which had a capacity to treat 2,100 tons of ore daily, was totally destroyed by fire. The second disaster, in which thirty-eight persons lost their lives and about twenty others were seriously injured, occurred on the night of October 28th, 1921, when more than half of the buildings in the town at Britannia Beach were destroyed by the high water in Britannia creek, which washed away a fill on the narrow-gauge electric railway connecting the beach with the 2,200-foot level in the *Britannia* mine, thereby causing a flood in the town.

These disasters are the most serious to visit any mining centre in the Province since 1915, when a snow and rock slide destroyed the old Britannia mining camp on the mountain-side at the foot of the Mammoth bluff on the 1,000-foot level at an elevation of about 3,200 feet above sea-level, which was the site of the first camp established by the original stakers of the *Jane* and *Fairview* mineral claims of the *Britannia* group in 1898. It is gratifying to state that the contracts are let for rebuilding the concentrating-mill with increased capacity, and that the town will also be rebuilt with as little delay as possible on a new site on higher ground well removed from the possibility of again suffering damage from a similar cause.

COAL-MINING.

The most important mineral industry on Vancouver island is coal-mining, which under normal conditions employs between 4,000 and 5,000 employees. During 1921 the gross production of coal on Vancouver island was 1,625,931 tons, compared with 1,698,254 tons during 1920, or a decrease of 72,323 tons.

All of the collieries are in the Nanaimo Mining Division, and these are the chief support of practically all of the towns on the east coast of Vancouver island northerly from Chemainus, which includes Ladysmith, Granby (formerly known as Cassidy), Extension, South Wellington, Nanaimo, Wellington, Lantzville, and Cumberland.

As the conditions of the collieries are reported on in detail in the Annual Report of the Minister of Mines by the staff of the Chief Inspector of Mines under the heading "Inspection of Mines," it is not the intention of the writer of this report to devote any space to such details, as they are outside of his own duties, but there are features regarding the coal-mining industry which do come within his proper sphere, and these are discussed as follows:—

The names of the companies, with the collieries they were actively operating during 1921, are as follows:—

Canadian Collieries (Dunsmuir), Limited, operating the Wellington-Extension Colliery, comprising Nos. 1, 2, and 3 mines at Extension and No. 5 mine at South Wellington, also Nos. 4, 5, and 7 mines, Comox Collieries, at Cumberland.

Western Fuel Corporation of Canada, a reorganization of the Canadian Western Fuel Company, operating the No. 1 or Esplanade shaft, Protection island, Harewood, Reserve, and Wakesiah mines, Nanaimo.

Granby Consolidated Mining, Smelting, and Power Company, operating the Granby No. 1 Colliery, Cassidy.

Nanoose Collieries Company, Limited, operating the Lantzville mine, about 10 miles northerly from Nanaimo.

King & Foster, lessees of the Old Wellington Colliery, operating the Adit mine at Wellington.

There is another company in the Nanaimo coalfield, known as the East Wellington Coal Company, which started to open the East Wellington Colliery in 1920, about 500 yards west from the old Jingle Pot mine, worked out during 1919, but this company has not yet commenced to produce any coal.

During 1921 the conditions of the coal-mining industry on Vancouver island have not been normal, because the demand for coal has been quite irregular and so much less than during the past few years that the miners in nearly all of the collieries have not been working full time, and some of the mines have been closed down for a considerable portion of the past year.

The importation of fuel-oil for locomotives and steam-vessels has, of course, had a very serious effect on the market for steam-coal; the effect has not only been the direct one of reducing the demand for coal, but the indirect one of sending hundreds of thousands of dollars

out of Canada in payment for oil and exchange. In an endeavour to offset these very undesirable conditions, experts are working to determine the possibility of substituting powdered coal in place of oil.

The demand for bunker coal for coal-burning steamers has been light owing to the general depressed condition of trade the world over, resulting in a decrease in the number of vessels carrying freight, and has also afforded those an opportunity to fill their bunkers, as well as some of the freight-holds, with sufficient Welsh and other coal at the foreign ports of clearance to furnish fuel for the entire voyage, outward and inward bound.

Another cause for the decreased demand for coal is the fact that a number of vessels have brought several thousands of tons of Welsh coal to San Francisco and Honolulu as ballast from ports in England and have loaded lumber for return cargo.

One of the most noticeable features relating to the coal-mining industry on Vancouver island is the harmonious relationship that exists between the operators and their employees, for which both classes are to be heartily congratulated.

Improvements in Coal-washer Plants.—Another is the lively interest that is at present being taken by the operators in improving the washery plants, and the methods that are to-day being employed to clean coal are not only of the most modern description, but in the experiments in oil-flotation that have been carried on during the past year by the Western Fuel Corporation of Canada; the Canadian Collieries (Dunsmuir), Limited.; and the Granby Consolidated Mining, Smelting, and Power Company, these companies are taking the lead on the North American continent.

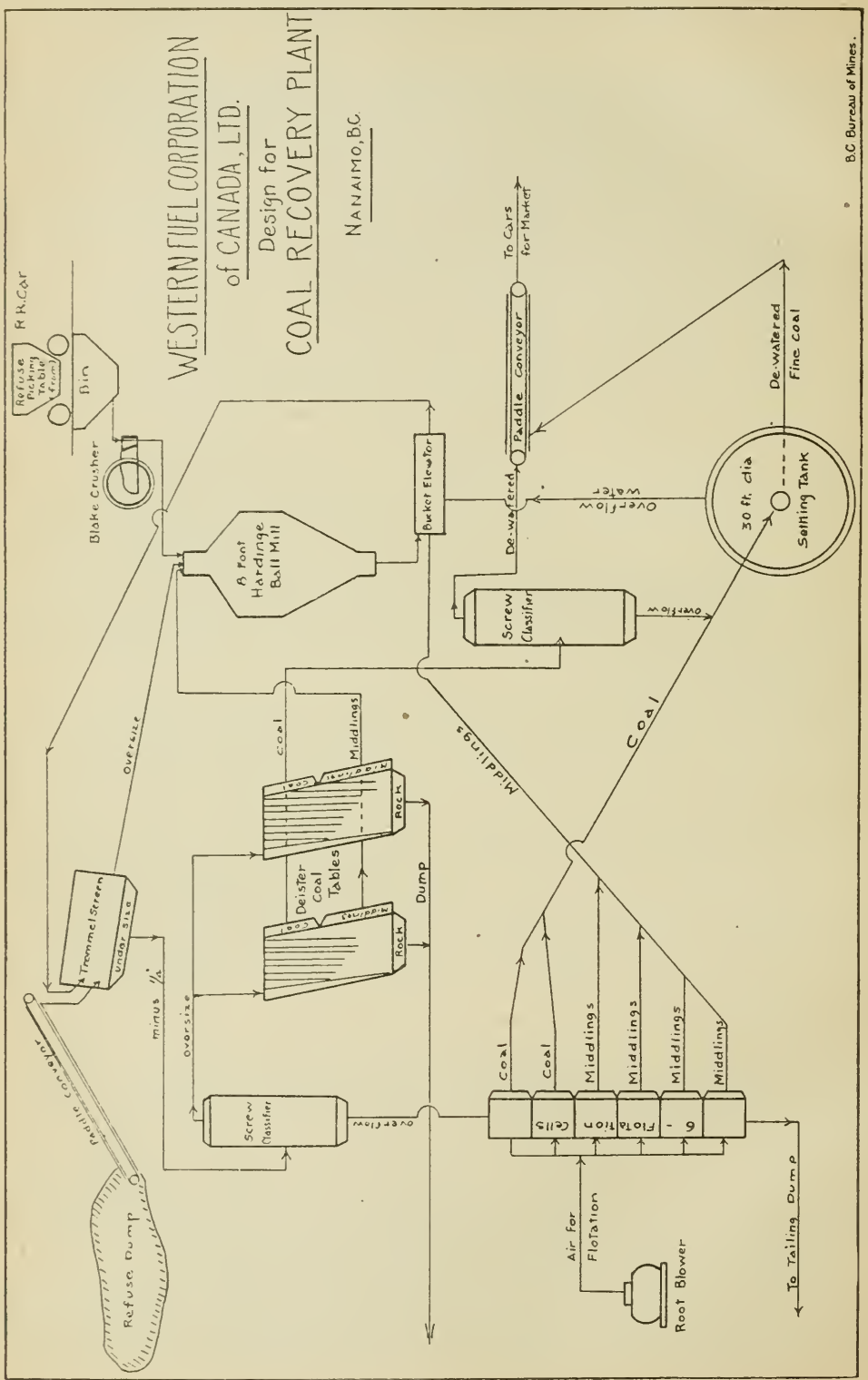
Western Fuel Corporation of Canada.—In this connection the following brief description of the improvements being made in the washery plant of the Western Fuel Corporation of Canada at Nanaimo is interesting: The company assembles all of the coal produced at its various mines at a central point on the water-front in Nanaimo, where the bunkers, wharves, car-ferry slip, blacksmith, machine, and carpenter shops are located in the vicinity of No. 1 shaft, Esplanade, up which is hoisted the coal produced in that mine. The product from the Reserve, Harewood, and Wakesiah mines is transported to the central station on the water-front over the company's system of private railway-tracks.

John Hunt, the general manager of the Western Fuel Corporation of Canada, is entitled to much credit for the enterprise he has shown by authorizing the construction of the new washery plant, and especially for taking the lead in utilizing the oil-flotation process in the plant on a commercial scale. There are two main objects in making the improvements, and practically applying the science of concentration as employed in the metalliferous mines to coal-mining. These are: First, to produce the cleanest coal possible for the market; and, second, to make a product of commercial value from material that has heretofore been considered waste. The improvements as designed for the proposed new plant indicate an important stride along the road of progress. In the past coal-mines generally have been equipped with washery plants in which the Robinson cone washers were used, and it has been customary on Vancouver island to treat the residue from the washer by passing it through jigs and over concentrating-tables in order to clean the smaller sizes of coal, such as pea and nut, but no serious effort has heretofore been made to further concentrate the slack and sludge, which have gone to waste-dumps or been deposited in the sea.

The plant which is under construction and the machinery for which is all purchased is expected to be in operation during the coming summer; it is designed by P. E. Peterson, one of the pioneer operators in concentrating by the oil-flotation method and inventor of the Peterson cell, which has to a great extent supplanted the Callow and other cells heretofore used in oil-flotation.

The flow-sheet as illustrated in the accompanying plan shows an absence of intricate construction not often found in connection with such works; indeed, the whole scheme is so simple that two men, or one man and a boy, on a shift will comprise all the labour necessary to operate the plant. This plant will be used in addition to the present washery, in which jigs have been discarded and four Deister coal-concentrating tables substituted.

A reference to the flow-sheet shows the two sources from which the product to be treated is drawn—one a refuse-dump on the upper left-hand corner of the plan; the other, refuse from the picking-tables in the present washery, delivered on the upper floor of the new plant in railway-cars, as shown on the upper right-hand corner of the plan. The material in the refuse-dumps is


WESTERN FUEL CORPORATION
of CANADA, LTD.
Design for
COAL RECOVERY PLANT
NANAIMO, B.C.
B.C. Bureau of Mines.
R.R. Car
Refuse Picking Table (from)
Bin
Blake Crusher
6 Foot Hardinge Ball Mill
Bucket Elevator
To Cars for Market
Paddle Conveyor
De-watered
Overflow Water
30 ft. dia
Settling Tank
De-watered Fine Coal
Screw Classifier
Overflow
Coal
Middlings
Overflow
Trommel Screen
Under Size
Deister Coal Tables
Rock
Dump
minus ½"
oversize
Screw Classifier
Overflow
Coal
Coal
Middlings
Middlings
Middlings
Middlings
6 - Flotation Cells
Air for Flotation
Root Blower
To Tailing Dump
Refuse Conveyor
Refuse Dump

carried into the plant by a paddle-conveyor, which delivers it on to a trommel-screen; the oversize passes from the trommel by gravity down a launder to an 8-foot Hardinge ball-mill; the undersize passes by gravity into a screw-classifier, the oversize from which passes by gravity on to two Diester coal-concentrating tables. These tables produce three products—viz., coal, middlings, and rock. The undersize or overflow from the screw-classifier is carried by gravity to a battery of six Peterson flotation-cells; the product from two of these cells is clean coal and from the other four middlings. The coal from the flotation-cells passes by gravity into a settling-tank 30 feet in diameter, from which the dewatered fine coal passes to a paddle-conveyor, by which it is carried to railway-cars ready for market. The middlings from the flotation-cells pass by gravity along a launder to a bucket elevator near the ball-mill, into which the overflow water from the settling-tank is also discharged. The bucket elevator discharges into a launder, along which the material passes by gravity on to the trommel-screen already mentioned and is subjected to the same series of treatments as has just been described. The coal and middlings concentrates made on the Deister tables are carried by gravity to a second screw-classifier near the settling-tank, so that the overflow from the classifier can discharge into the settling-tank, while the fine dewatered coal is carried to the paddle-conveyor, which delivers it into railway-cars ready for market. The refuse brought in railway-cars from the picking-tables below the main tipple is dumped into a bin below the track and from there goes into a Blake crusher, which discharges into the Hardinge ball-mill.

One of the advantages to be gained by the treatment described of the slack or refuse is that the coal can be more thoroughly picked over on the picking-tables and a cleaner product made, because practically all of the carbon in the refuse is later saved in the concentrating-washer. Heretofore many lumps of coal with which was associated only a small percentage of rock were allowed to pass to market, but in the future all of such material will be discarded at the picking-tables to be treated by concentration.

Canadian Collieries (Dunsmuir), Limited—Comox Mines.—The washery plant for the Comox mines is at Union Bay, where the product from those mines is assembled for water shipment from the large bunkers at the wharves. The coal is transported from the mines over the company's private railway, a distance of about 14 miles. The washery is fully equipped with Robinson cone coal-washers and ten Masco coal-concentrating tables. The company has during the past year been experimenting with oil-flotation, and forwarded some car-load lots to the Mineral Separation Company at San Francisco, as well as putting in a small experimental laboratory plant at Union Bay, but has not as yet adopted the treatment on a commercial scale.

The following is a brief description of the improvements made on the surface during 1921:—

Extensive repairs were carried out on the flume of the hydro-electric plant. The large area covered by the underground operations at No. 4 mine, Comox, has for some time been taxing the ventilating facilities at that mine. In October of the present year operations were started to install a second fan, and with the new installation completed, the Nos. 1 and 2 slopes of this mine will be ventilated each by a separate ventilation unit.

The present unit consists of a Sullivan double-inlet fan, having a capacity of 180,000 cubic feet a minute, against a 6-inch water-gauge. The fan is electrically driven by a 350-horse-power induction-motor, 2,200 volts, speed 250 r.p.m., directly connected to the fan-shaft. This fan will in future ventilate the workings of No. 2 slope, while the new installation will take care of the workings of No. 1 slope.

The new unit is situated just west of the travelling-way, and in order to make room for the installation extensive changes were made in the railway-yard, which not only increased the capacity, but added much to the efficiency and appearance of the whole plant.

The new fan plant consists of a 108-inch double-inlet reversible Sirocco fan on concrete base with half-housing in steel. The fan will be connected to the mine by a reinforced-concrete tunnel fully equipped with explosion-doors. The fan will run at 250 r.p.m. and will deliver 200,000 cubic feet of air a minute, against a 6-inch water-gauge.

The primary power unit will be a 500-horse-power synchronous motor, 2,200 volts, equipped with a self-starting unit; the motor will run at 500 r.p.m., connected to the main shaft of the fan through a jack-shaft with silent chain-drive in two sections, each 15 inches wide, the ratio between the motor and fan speed being 2 to 1; the distance between centres of drives will be 106 inches.

In addition to the primary drive, there will be carried as an emergency unit a 350-horse-power induction-motor, speed 250 r.p.m., which can be connected by a coupling direct to the main fan-shaft. This induction-motor is a duplicate of the motor now in use on the present ventilation units at No. 4 mine and also at Nos. 5 and 6 mines, and can in emergencies be used on any one of the three units.

The power unit will be housed in a fire-proof concrete building with asbestos roofing, and, in all, makes one of the most complete and efficient ventilating plants in the Province.

Diamond-drilling.—During the year diamond-drilling was continuously prosecuted in the Tsable and Cumberland fields. Much of the time three drills were in operation; one was withdrawn in October and transferred to the Ladysmith district.

In the Tsable River district, to the 115,220 feet of roads made to facilitate movement of drills and 15,051 feet of holes drilled during 1919 and 1920, there was added in 1921 12,900 feet of roads and 6,991.6 feet of drilling; all of this drilling gave a 2-inch core. In the Cumberland district 12,300 feet of roads were made to facilitate movement of the drills and 3,370 feet of holes drilled; making a total for the year in the Comox field of 25,200 feet of roads made and 10,361 feet of holes drilled.

The operations of the Canadian Collieries (Dunsmuir), Limited, in the Extension and South Wellington fields, Nanaimo Mining Division, have been carried on satisfactorily during 1921. The production of coal from the company's mines in those fields shows an increase during the past year of 10,253 tons.

Systematic prospecting with diamond-drills has been carried on in two sections of the coalfield—Haslam flat, Oyster district, a few miles southerly from Cassidy; also near the Nanaimo river, Cranberry district. This prospecting is on the Wellington coal-seam, the deepest of the three seams in the Nanaimo field.

Three boreholes have been put down on Haslam flat; two of these are 1,500 feet deep and the third is 900 feet. Good coal of workable thickness has been exposed, but the prospecting has not yet been sufficient to warrant opening a new mine.

About 300 feet of drilling has been done near the Nanaimo river, in the Cranberry district, on the line of the company's private railway from Extension to Ladysmith.

At South Wellington No. 5 mine two rock tunnels are being driven to the south off the Main slope a distance of 2,500 feet, which are expected to develop a large area of good coal.

At Ladysmith, where all of the coal produced at the Wellington-Extension and South Wellington Collieries is assembled for shipment, improvements have been made in the washery plant which have resulted in the recovery of a larger percentage of pea coal than in the past. These improvements comprise the erection of a shaker screen, automatic water-feed, and settling-tank as auxiliaries to the three Masco coal-concentrating tables in use for some time past.

Granby No. 1 Colliery, Cassidy.—During 1921 R. R. Wilson, who has been superintendent for the Granby Company at the colliery since 1919, resigned, and was succeeded by E. E. Campbell, who had been connected with the Granby Company at Phoenix since 1900 and was mine manager for several years. Under the management of R. R. Wilson the colliery at Cassidy was placed on a shipping basis, the production being increased from 72,885 tons in 1919 to 268,962 tons in 1921.

The title of the Granby Company to the coal rights under areas of land near Cassidy acquired in 1917 from original settlers on the Esquimalt & Nanaimo Railway Company's land belt was confirmed by the Privy Council in November last. This decision settles the litigation that has been pending since 1917, when the Granby Company purchased the property on which it has opened the coal-mine known as the Granby No. 1 Colliery and built a model town for its employees, with all modern conveniences, recreation-grounds, club-house, shower-bath house, change-rooms, etc.

During 1921 this colliery produced 268,962 tons of coal, as compared with 201,589 tons in 1920. The coal-mine is operated primarily to supply coal for manufacture into coke in the battery of by-product coke-ovens at Anyox for fuel for the company's copper blast-furnaces at that point, about 600 miles up the Mainland Coast from the Granby No. 1 Colliery.

During 1921 experiments have been carried on with a view to improving the methods of further cleaning the sludge, which at present passes off from the Diester-Overstrom tables in the washery plant as waste. It was at this colliery that the first successful attempt to apply the oil-flotation method of concentration to coal was made by P. E. Peterson in the spring of 1921.

The object desired to be attained was to reduce the content of ash in the slack coal used for the manufacture of coke to that point where it would not exceed 15 per cent. ash as it came from the washer, and it was found to be possible by oil-flotation to clean such material, after it had been ground fine, so thoroughly that a product carrying as low as 15 per cent. ash was saved, the proportion being sufficiently great to result in profitable operations on a commercial basis.

Old Wellington Colliery.—King & Foster, the lessees of this coal-mine, have worked continuously during 1921 on a limited scale, owing chiefly to lack of capital to branch out. The The lessees are successfully attempting to reopen the mine and pay for the operations from the income received from the product. Most of the work has been the drawing of old pillars, and they are succeeding in this attempt, the product being gradually increased to a point where it is beginning to be of importance.

The coal is of excellent quality. This is the original mine operated so successfully by Hon. Robert Dunsmuir before he built the Esquimalt & Nanaimo Railway, and when the bulk of the production was shipped from Departure bay to San Francisco by sea.

Pacific Coast Coal Mines, Ltd.—This company not only did not operate during 1921, but all of its property, including the Morden coal-mine near South Wellington and the Suquash coal-mine in the north-eastern portion of Vancouver island, as well as all equipment, was sold at Sheriff's sale and purchased by Montreal interests.

Nanoose Collieries Co., Ltd.—This company increased its production from the Lantzville mine, about 10 miles north-westerly from Nanaimo, from 32,500 tons of coal in 1920 to 55,942 tons in 1921. The company ships all of its output by water, and is considerably handicapped during stormy weather, because there is practically no shelter for vessels at the company's wharf.

East Wellington Colliery.—This colliery has not yet become a producer of coal. John John, the mine manager, has been occupied in completing the erection of the necessary buildings and installing the machinery on the surface, in order to be prepared to take advantage of better market conditions by having the mine in shape to commence production when such is warranted by the demand. The coal from this colliery when production begins will be shipped over the same railway-track as was the case when the old Jingle Pot mine was being operated, from which the coal was delivered to scows and vessels from the wharf not far from the old gaol on the Nanaimo water-front.

METALLIFEROUS MINING.

The concentrating-mill at Britannia was closed down on November 30th, 1920, and the mill at the *Indian Chief* mine, Sidney inlet, west coast of Vancouver island, was also closed down about the same time, while production at the *Marble Bay* mine, Texada island, ceased during 1920. These were the only producing metalliferous mines in the Western Mineral Survey District, and no others were added to the list during 1921, consequently when considered from a production basis the condition of the metalliferous mineral industry in this district during 1921 has been discouraging. On the other hand, however, when the results from development-work and prospecting that have been carried on during the year in various sections of the district are considered, there is every reason for a feeling of optimism to prevail with regard to the future condition of the industry.

During 1921 several mining engineers were in the district searching for prospects that might be attractive to their principals.

Prospecting.—The Consolidated Mining and Smelting Company of Canada has had parties of mining engineers engaged in field-work prospecting the section of Vancouver island known as the Esquimalt & Nanaimo Railway Belt, but no results from that work have been made public. This examination was made by the smelting company at the request of the Esquimalt & Nanaimo Railway Company, and in accordance with an agreement entered into by the railway company with the Honourable Minister of Mines, in an effort to consummate some arrangements by which the present dual control of the minerals in the Railway Belt can be eliminated. At present the Esquimalt & Nanaimo Railway Company is the owner of all coal and base metals occurring within the boundaries of the Railway Belt, while the title to any precious metals occurring within the belt is in the Crown.

The prospecting-work done by these parties has been confined almost entirely to the Nanaimo Mining Division.

In the Quatsino Mining Division, Wm. Clancy, manager of the *Old Sport* mine, owned by the Consolidated Mining and Smelting Company of Canada, has been occupying much time in prospecting and making a detailed geological survey of the mountainous country in the vicinity of the *Old Sport* mine in an endeavour to determine more fully than is at present known the extent, structure, and geologic conditions of several ore-deposits that occur in the north-westerly portion of Vancouver island.

Development-work on the *Old Sport* has been suspended awaiting the erection of a concentrating plant on that property, which construction was a part of the programme proposed to be carried out in 1920, but was postponed owing to the high costs for building and difficulties in procuring machinery for the plant, as well as the demoralized condition of the copper market.

Prospecting generally in the Western Mineral Survey District has been carried on in some sections with more energy than for some years past, but this work, so far as Vancouver island is concerned, has been principally confined to further search for gold-bearing quartz and ores in the neighbourhood of Kennedy lake and in the Beaufort range of mountains, on the westerly slopes, where veins of gold-bearing quartz were discovered about 1898, but under the conditions prevailing at that time were considered to be too narrow to permit of being worked on a commercial scale. On the Mainland portion of the Western District there has also been a tendency to confine prospecting to a search for gold rather than copper or silver ores; consequently the Fire Mountain section near the head of Harrison lake has received some attention from prospectors during 1921.

The Coast range on the Mainland is apparently becoming a more attractive field for prospectors than in the past. Several occurrences of fair-grade ore in the altered sedimentaries which are found as undestroyed roof-pendants intruded by the Coast Range granodiorite batholith have been discovered during the past two or three years. Most of these have been examined and some are reported on later in this report. One feature especially with regard to these deposits is worthy of mention. It is that they are almost universally found to occur at high altitudes and isolated. They are only found as the result of intensive prospecting on and near the summits of the mountains and usually close to or above the timber-line. Many of such deposits have been first discovered by energetic men who associate big-game hunting and trapping with prospecting.

ALBERNI MINING DIVISION.

There has been but little activity in mining in the Alberni Mining Division during 1921. The annual assessment-work has been generally done on the mineral claims not Crown-granted, but no serious attempt to extend development-work has been made. Mining engineers from San Francisco and other centres have examined several of the older mineral claims for their principals, but to date there has been no advice that any properties have been bonded.

During the past summer, E. F. Eastman, managing director of the Tacoma Steel Company, accompanied by E. Stephens, general superintendent, examined several iron-ore claims at and near Sechart, near the western channel of Barkley sound. These claims are all Crown-granted and owned by the Tacoma Steel Company. No results of the examination were made public. The claims were reported on in the Annual Report of the Minister of Mines for 1916.

The *Big I.* group of mineral claims on Big Interior mountain, at the head of Drinkwater river, 10 miles from the head of Great Central lake, which were bonded to the Consolidated Mining and Smelting Company of Canada in 1919, reverted to the original owners during 1921.

As reports have been published in the past Annual Reports of the Minister of Mines on the majority of the mineral claims in the Alberni Mining Division, it is unnecessary to repeat in this present report. For that reason the following two reports only are included. These are on groups of mineral claims which were examined during 1921, but have not been reported on for some years. These are the *W.W.W.* and the *Gretna Green* groups.

W.W.W. Group. This group of mineral claims is in the southern portion of Vancouver island, near the heads of China and Granite creeks and the Franklin river, which was brought into considerable prominence about 1899 by the discovery of quartz veins carrying good gold values, with much of the quartz showing particles of free gold visible to the naked eye. The W.W.W. group was more thoroughly prospected by the locators

than any other claims, and was eventually sold to Wm. Harris, of Spokane, one of the original owners in the *Le Roi* mine at Rossland. After operating for about two years work was stopped. Since then, except during a short period in 1908, the section has received no attention until about October, 1921. During 1920 the *W.W.W.* group was advertised at tax sale and was purchased by H. Davie, of Port Alberni, who in due course received title from the Government, and later sold to R. G. McLeod, of the McLeod-Slocan Mining Syndicate, Limited, Vancouver. The present owner proposes to reopen the old workings on the claims, extend the development-work, and operate on a commercial scale by erecting a small milling and concentrating plant.

Area and Title.—The *W.W.W.* group contains four Crown-granted mineral claims known as the *W.W.W. Nos. 1, 2, 3,* and *4,* comprising approximately 200 acres. A bond has recently been taken by R. G. McLeod, of Vancouver, from H. Davie, of Port Alberni.

Geography.—The *W.W.W.* group of mineral claims is in the Alberni Mining Division near the headwaters of Franklin river, which has its source in the Beaufort range of mountains, no great distance from Mount Arrowsmith, the highest peak in the southern portion of Vancouver island. The Franklin river empties into the Alberni canal on the east side, about 10 miles southerly from Port Alberni, the head of navigation for ocean-going vessels. The *W.W.W.* group is reached by travelling an old pack-trail in an easterly direction from near the mouth of the Franklin river for a distance of about 12 miles.

Geology.—The *W.W.W.* group is in that portion of Vancouver island the geology of which is described in Memoir No. 13, Southern Vancouver Island, by Chas. H. Clapp, Canada Department of Mines, Geological Survey Branch, 1912. Clapp in his report merely refers to the section in which the *W.W.W.* group is situated, as follows: "A large number of claims have been staked on a group of deposits near the headwaters of Franklin river and China creek, in the Alberni, Dunsmuir, and Barkley districts. These claims were not visited, so that their character is not known. Some of them may be contact deposits, but it is probable that they are chiefly impregnated and partially replaced shear-zones."

On the map accompanying Clapp's report the section is shown as being made up of rocks classified as Saanich granodiorite and Vancouver volcanics, with the first named occurring along the east shore of Alberni canal, in the vicinity of the mouth of Franklin river, and extending south-easterly about 12 miles with the contact occurring between the Saanich granodiorite and the Vancouver volcanics at a point about 6 miles up the Franklin river. The area covered by the volcanics is apparently quite extensive, but undetermined.

The writer of this report is of the opinion that the country-rock surrounding the *W.W.W.* group of mineral claims belongs to the Vancouver Volcanic series.

Ore-deposits.—There is a well-defined vein-structure in a shear-zone on the *W.W.W.* group. The ore is deposited in fissures which have clean-cut walls, but vary considerably in width from a few inches up to 14 inches. There is gouge on each wall and the vein-filler is made up almost entirely of quartz mineralized with iron pyrite and some free gold.

There are apparently two fissures, or possibly a linked-vein system in a shear-zone in which the links or lenses of mineralized quartz occur *en echelon,* with a structure somewhat similar to the shingles on the roof of a building. The strike of each of the fissures is S. 10° W. (mag.) and dip about 45° towards east.

In the upper adit as shown at present the length of the pay-shoot in the vein, of sufficient width to be considered workable, or exceeding 12 inches, is approximately 30 feet, but the fissure is continuous, though in places much narrower for 72 feet, the full length of the adit. At the face the values in gold are high, with some indications that the vein may widen out.

In the lower adit, which is 117 feet long, the pay-shoot in the workable part of the vein is about 40 feet long, but the fissure is continuous the entire length of the adit. There is a stope 33 feet long and about 20 feet high from the lower adit, also a winze of unknown depth, being full of water. The stope is about 60 feet from the portal of the adit and extends to within 16 feet of the face. The winze is sunk across the adit from the stope.

Some shipments of high-grade ore were packed out on horses, and which were made about 1900 to the Tacoma smelter, were presumably mined from the stope and winze in the lower adit, as well as from the drift-adit.

Samples and Assays.—Three samples were taken during the examination, which assayed as follows:—No. 1, from 6 feet from the face and up to the face of the lower adit, quartz about 6 inches wide, assayed: Gold, 0.24 oz.; silver, 0.16 oz.; copper, trace. No 2, from face of upper

adit, quartz 6 inches wide, assayed: Gold, 5 oz.; silver, 4.5 oz.; copper, 0.3 per cent. No. 3, selected samples of decomposed quartz from near the portal of the upper adit above the roof, assayed: Gold, 14.84 oz.; silver, 8 oz.; copper, trace.

The above-mentioned samples do not represent the average value of the vein in either adit, as no attempt to determine the average value was made; the places from which the samples were taken were selected at haphazard, except No. 3 sample, which was selected to show the values carried by the decomposed quartz at that particular point.

Following is a list of assays made from samples taken by the owner at various times and is reproduced here merely as an illustration:—

Copies of Assays made on Samples of Ore from W.W.W. Group.—P. W. Thomas, Provincial Assayer: Decomposed ore—Gold, 6.42 oz., $128.40; silver, 6.04 oz., $3.92; total, $132.32. Arsenical ore—Gold, 4.90 oz., $98; silver, 3.72 oz., $2.42; total, $100.42.

West Assay Works, October 14th, 1921: Gold, 4.65 oz., $93; silver, 6.34 oz., $4.57; total, $97.57.

Consolidated Mining and Smelting Company: Gold, 2.90 oz.; silver, 2.07 oz.; lead, 4.09 oz.

Tacoma smelter: Gold, 5.58 oz.; silver, 4.20 oz.; total, $111.60.

J. R. Williams, Provincial Assayer and Chemist, 621 Pender Street West, Vancouver, October 27th, 1921: Sample No. 1, gold, 21.16 oz., $423.20. Sample No. 2, gold, 7.92 oz., $148.40. Sample No. 3, gold, 10.44 oz., $208.80; silver, 6.96 oz., $4.87; total, $213.67.

J. R. Williams, October 31st, 1921: Amalgamation test—Average of three assays, $261.75; amount of free gold, $120.

Development-work.—The development-work on the W.W.W. group consists of two adits, each one driven as a drift following the strike of the vein system from the surface outcrops in the side of a mountain at an elevation of about 2,000 feet above sea-level. The lower of these adits is 117 feet long. At a point about 69 feet from the portal a stope has been opened, which is 33 feet long; there is also a winze of unknown depth sunk on the opposite side of the adit from the stope. The upper adit is 72 feet long.

There is an ample supply of water near by the mine-workings for power and concentrating purposes, which can be developed at a comparatively low cost.

Gretna Green Group.

This group of mineral claims, at the head of Henderson lake, is in the interior of Vancouver island from the west coast, and is not described in either of the Summary Reports, 1919 or 1920, Geological Survey, Canada, by V. Dolmage in his notes on "Barkley Sound" and "West Coast, Vancouver Island, between Barkley and Quatsino Sounds," and, so far as the writer knows, no detailed examination of the geology of the section has been made, nor have prospectors explored the interior any considerable distance from the shores of Barkley sound or Alberni canal. The large number of islands, length and irregularity of the shore-line, has offered advantageous opportunities to explore the shore-lines, while the dense underbrush, almost impenetrable forests, and rugged mountains, which usually rise almost perpendicularly from the shores, have retarded prospecting to any considerable distance into the interior. For these reasons there is a very large area in that section of the interior from the west coast of Vancouver island, extending in a northwesterly direction from Uchucklesit harbour near the entrance to Alberni canal to near Quatsino sound, that has never been explored by white men.

Considerable interest was shown about 1898 and 1899 by prospectors along the shores of Uchucklesit harbour, Snug basin, and Henderson lake, but the rapids between the harbour and lake presented a transportation problem which to a prospector, or even a company with limited capital, appeared almost insurmountable; consequently, during the past twenty-two years but little attention has been paid to that section.

Outcroppings of high-grade copper ore in contact-metamorphic deposits occur in several places near the shore-line of Uchucklesit harbour, Snug basin, and near the head of Henderson lake, one of which is on the *Gretna Green* group, but no really extensive systematic prospecting with the view of attempting serious development-work has been done, principally for the reason that the occurrences of ore were usually in kidneys and so irregular as to discourage operators.

Area and Title.—The *Gretna Green* group contains four mineral claims owned by George Brown, of Vancouver.

Geography.—The *Gretna Green* group of mineral claims is about a mile northerly from the fish-hatchery at the head of Henderson lake, which is about 12 miles long and empties into

Tidewater Copper Co.—Mine Buildings.

Emancipation Mine—Liberator Mining Co.

Uchucklesit harbour through a series of rapids. Uchucklesit harbour is an arm of Barkley sound on its north side at the entrance to Alberni canal. Uchucklesit harbour, in connection with Snug cove at the north-westerly end of the harbour, affords one of the best and most commodious shelters for vessels of any draught on the west coast of Vancouver island.

Geology.—On the *Gretna Green* group there occurs a highly metamorphosed zone with a contact between limestone and a rock resembling diorite, associated with which contact there occurs masses of such contact-metamorphic rocks as garnet and epidote. In the belt of limestone there are several cliffs which rise above the normal level to elevations of from 100 to several hundred feet. These cliffs are usually quite precipitous, and at the contact with the igneous rock there are usually narrow canyons and watercourses resulting from erosion. The contacts are generally well defined, but in some instances the metamorphism has been so pronounced that the point of actual contact is hidden and difficult to determine with certainty.

Ore-deposits.—At a point about 100 feet higher elevation than Henderson lake, near the easterly bank of a creek, there is a prominent cliff of limestone, and apparently near the contact between it and an igneous rock resembling diorite there occurs an outcropping of exceedingly high-grade copper-sulphide ore, more or less associated with contact-metamorphic minerals. The ore appears to have replaced limestone, as the best ore is more often found in kidneys and bunches, surrounded on all sides by limestone almost crystallized to marble, rather than in association with the contact-metamorphic minerals, but it is noticeable that unless some garnet or epidote occurs near by there is as a rule no copper ore.

The condition of the ore-deposit and surrounding country-rock is such that, although the ore is exceptionally high grade, the indications appear to show that the quantity is so limited, its occurrence so erratic and irregular, as to suggest that, while further and systematic prospecting may result in exposing more favourable conditions, it must be regarded in the light of a possibility rather than a probability, but is an absolute necessity before any value can be estimated for the *Gretna Green* group of claims.

Samples and Assay.—One selected sample was taken from about 100 lb. of ore, all that was exposed, which assayed: Gold, 1.4 oz.; silver, 1.5 oz.; copper, 17.8 per cent.

Development-work.—No work other than some prospect-holes could be found, and Nature's handiwork was more noticeable than man's in excavating these holes.

CLAYOQUOT MINING DIVISION.

During the summer of 1920 a geological survey of the west coast of Vancouver island between Barkley and Quatsino sounds was made by V. Dolmage, and his summary report is published in Summary Report, 1920, Part A, Canada Department of Mines, Geological Survey. In the beginning of Dolmage's report, under the heading "General Description," he says: "The coast between Barkley and Quatsino sounds, consisting, as it does, of three large sounds with numerous inlets and islands, among which may be found many excellent harbours, is the most irregular part of the west coast of Vancouver island. It differs markedly from the rest of the west coast, which is so straight and regular that it offers almost no protection to coasting vessels. The shore, in general, is bold and rocky and sparsely timbered with stunted conifers; but in a few places, such as Estevan point and in the vicinity of Wreck and Long bays, extensive sandy and bouldery beaches are developed at the base of low perpendicular cliffs. This part of the island is thinly populated, chiefly by Indians of a most primitive type; a few white people are engaged in fishing and canning and to a slight extent in mining, lumbering, and ranching. The only means of communication is by the Canadian Pacific Railway steamer 'Princess Maquinna,' which makes the round trip from Victoria to Quatsino three times each month."

Under the heading "Geology" he gives the following table:—

"The following table of formations summarizes the geology of this part of Vancouver island:—

"TABLE OF FORMATIONS.

Age.	Formation.	Character.
Recent		Stream and river gravels.
	"Unconformity.	
Pleistocene	Wreck Bay formation	Stratified sands, gravels, and clays.
Lower Cretaceous or Upper Jurassic	Cretaceous sediments	Sandstone and conglomerate.
Jurassic	Coast Range batholith	Granodiorite, quartz diorite, diorite.
	"Intrusive.	
Triassic	Vancouver group	Andesites, tuffs, tufaceous argillites, and limestones."

As this Summary Report can be obtained on application to the British Columbia Branch of the Geological Survey at 510, Pacific Building, Vancouver, it is not necessary to quote further extracts at this time. Reports on all of the mineral claims described by Dolmage have been published from time to time in the Annual Reports of the Minister of Mines, and as there is practically no dissimilarity in the descriptions it is not considered essential to repeat the report here.

During a portion of the month of September and early part of October the writer visited the west coast of Vancouver island, and amongst the claims examined are the *You*, *White*, and *Wanderer* groups of mineral claims, reports on which follow:—

You Group. This group of mineral claims is in the most rugged part of the Beaufort range of mountains, near the southern boundary of Strathcona Park and not far from the centre of Vancouver island. The district has received a good deal of attention by prospectors since 1899, when Joe Drinkwater crossed the island from Bedwell river to Great Central Lake, discovered copper-sulphide ore, and staked the *Big Interior* group of mineral claims. The occurrence of persistent but narrow quartz veins carrying values in gold and silver higher than is usually found on Vancouver island made the district attractive to prospectors. The lack of transportation facilities, comparatively inaccessible situation, low grade of the copper ores, and expense of prospecting and developing these low-grade but extensive bodies have retarded the progress of the mining endeavor in this section of Vancouver island.

No reports have been made by the Geological Survey of Canada relative to the geology of that part of the interior of Vancouver island in which the *You* group of mineral claims is situated. Victor Dolmage, in the Summary Report, Canada Department of Mines, Geological Survey for 1918, described the geology of Quatsino sound; in the Summary Report for 1919 he described the geology of Barkley sound; and in the Summary Report for 1920 he describes the geology of the west coast of Vancouver island between Barkley and Quatsino sounds.

Area and Title.—The *You* group contains four mineral claims and occupies an area of approximately 200 acres. The owner is J. B. Woodworth, of Thorley Park, Vancouver.

Geography.—The *You* group of mineral claims is near the centre of Vancouver island, in the Clayoquot Mining Division, on the westerly slope of the Beaufort range of mountains at an elevation of about 3,000 feet above sea-level. The property can be reached either from Alberni via Great Central lake and Bear pass or from Clayoquot by launch to the head of Bedwell sound, from which point it is about 13 miles to the claims over a wagon-road for a distance of 9 miles and a pack-trail the remainder. The route from Clayoquot is usually travelled and is the only route by which supplies or machinery can be transported. By the Great Central Lake route men must pack on their backs across one of the highest and most rugged mountain ranges on

Vancouver island, and in addition to this drawback the route is usually closed by the deep snow in the mountains for at least six months of the year.

The mountain-peaks in the Beaufort range in the vicinity of the *You* group reach elevations exceeding 6,000 feet above sea-level. This range may be termed the backbone of Vancouver island. It is made up of mountain-peaks, the summits of many of which are so sharp as to have the appearance of saw-teeth, while the slopes are for the most part precipitous, but in many instances terraces and basins have been excavated near the summits by glacial action, and several isolated glaciers are observable from nearly any point near the head of Bedwell river. One of the largest of these glaciers is near Della lake at an elevation of about 4,300 feet above sea-level on the easterly slope of the Beaufort range.

Geology.—Dr. Dolmage, in the Summary Report for 1920, refers to the occurrence of gold-bearing quartz veins in the Kennedy (formerly Elk) River section near the head of Kennedy lake, about 24 miles almost due south of the *You* group of mineral claims, where the geology is so very similar to that surrounding the *You* group that his remarks are copied in part as follows:—

"Gold in small quantities is found in the beach placers of Wreck bay and in small quartz veins cutting the Vancouver volcanics in the vicinity of Elk river, which flows into the East arm of Kennedy lake. Gold-bearing quartz veins were known as early as 1898 to occur in the Elk River section. These veins occur in the andesite of the Vancouver group in close vicinity of large intrusions of a very fine-grained dark-grey diorite, with which the veins are thought to be genetically connected. The andesites are somewhat sheared, but, except in the immediate vicinity of the intrusions of diorite and the veins, are comparatively fresh. Where altered they consist largely of chlorite and secondary quartz, and near the contacts of the veins contain considerable pyrite. The diorite was not observed except in the vicinity of Elk river and the northern extremities of Kennedy lake, and showed—by the fact that it formed dykes in the granodiorite of the Coast Range batholith—that it belongs either to an exceedingly late phase of the batholith period or to some subsequent period of intrusion. No evidence could be found to determine which. The veins are all small, that on the *Rose Marie* being the largest. They have a common and persistent attitude, striking about N. 45° E. and dipping north-west 70° to 80°. They consist of coarsely crystalline quartz containing many vugs and small grains of pyrite, galena, zinc-blende, tetrahedrite, and gold which is sometimes visible.

"These gold-bearing quartz veins constitute a type of mineral-deposit which is different from any previously described in connection with the west coast of Vancouver island, and although they have not yet proved to be of commercial importance, they do in places carry good gold values and may with further prospecting and developing turn out to be valuable. From an examination of the Wreck Bay formation and of the intervening topography, it seems almost certain that the gold content of those gravels originated in the quartz veins of this district."

Ore-deposits.—On the *You* group of mineral claims there occurs a gold-bearing quartz vein in a fissure in a shear-zone in the Vancouver volcanics. The fissure is about 3 feet wide between very persistent, well-defined walls, with several inches of gouge separating each wall from the material which fills the fissure. The vein-filler is made up of quartz from 6 to 9 inches wide, some breccia, and gouge. The quartz is mineralized with iron pyrite, galena, zinc-blende, tetrahedrite, and gold, which often occurs free and visible to the naked eye.

The fissure is exposed in a narrow gulch, the effects of erosion, for a vertical height of about 500 feet above the trail, where an adit is driven along the strike of the vein in a north-easterly direction. The dip of the vein is practically vertical. Owing to the quantity of water flowing down the gulch no close examination could be made of the vein above the adit on the trail. The fissure, with similar filling, has been traced down the mountain-side for a distance of about 500 feet below the trail, where it has been exposed in open-cuts made at intervals.

Samples and Assays.—Four samples were taken from the adit, which assayed as follows:—No. 1, general sample from dump: Gold, 2.92 oz.; silver, 2.6 oz.; copper, 0.5 per cent. No. 2, from across 8 inches quartz 24 feet from portal: Gold, 3.56 oz.; silver, 3.4 oz.; copper, 0.2 per cent. No. 3, from across 8 inches quartz 36 feet from portal: Gold, 0.92 oz.; silver, 0.8 oz.; copper, *nil*. No. 4, from across 4 inches quartz near face of adit: Gold, trace; silver, trace; copper, *nil*.

Development-work.—The development-work on the *You* group of mineral claims consists of several open-cuts and on adit driven 78 feet as a drift along the strike of a quartz vein. The backs above the adit level rise very steeply, so that within a comparatively short distance

they will reach several hundred feet and expose a considerable tonnage of ore. Owing to the regularity of the walls of the fissure, the friable character of the vein-filler, and width, it is possible to mine the ore at a low cost.

The facilities for milling and concentrating could hardly be excelled, for the reason that Bedwell river can be developed to furnish all the water-power necessary to drive all machinery, as well as for concentrating purposes. Considered from a commercial standpoint, there is a good chance for Woodworth's operations to result satisfactorily, provided the high gold values in the quartz are persistent and he carries on operations economically as an individual concern free from the usual excessive overhead charges of most companies.

White Group.

This group of mineral claims was described in the Annual Report of the Minister of Mines for 1919, page 198, but as further work has been done since then, the group was again examined by the writer on September 28th, 1921. The *White* group is on Tofino creek or, as it was formerly named, Deer creek, which empties into the head of Tofino inlet, which is the southernmost arm of Clayoquot sound. Tofino inlet penetrates the coast of Vancouver island in a north-easterly direction for about 12 miles, the entrance being separated from the Pacific ocean by a narrow peninsula, on the ocean side of which is Long beach, that has derived its name from the extensive sandy beach that stretches along the ocean shore for several miles and suggests a promising site for a popular summer resort.

About 6 miles from its head, Tofino inlet is divided into two arms, the westerly one being about 3 miles long, to the mouth of Tranquille creek, while the easterly or main arm, which extends to the mouth of Tofino creek, is about 6 miles long. The two arms are separated by a narrow mountainous peninsula, an extension of the high precipitous mountain range that forms the divide between Tofino and Tranquille creeks. The mountain range was a much-favoured field for prospectors about 1898, when several groups of mineral claims were located, some of which have since been Crown-granted, but none have been developed to any great extent and all of them are still held by the original locators.

The mountains south-easterly from Tofino creek, which form the divide between it and Kennedy Lake and river, were also much favoured by prospectors about 1898, when several groups of mineral claims were staked. Most of these are in good standing to-day and are still held by the original locators.

The exceptionally high-grade copper-sulphide ores found outcropping on the surface appealed to the prospectors of that time, but lack of transportation from the mountains to the sea-coast, distances varying from 1 to 3 or 4 miles, together with the fact that all of the ore-deposits belong to the contact-metamorphic type, in which the ore occurs in irregular lenses, have retarded the progress of mining development.

Attention is here called to this section of the west coast of Vancouver island in this report because it appears to offer one of the most attractive fields for the prospector on the island, and its possibilities are very promising.

Area and Title.—The *White* group contains the *White*, *Norman*, *Walton*, *Dunlop*, and *Alpha* mineral claims, covering an area of approximately 250 acres. The group is owned by Duncan McMillan, of Victoria, and Wm. Walton, of Clayoquot.

Geography.—The *White* group is about 120 miles, as the crow flies, north-westerly from Victoria, but under present transportation facilities it is necessary to travel considerably farther, as the Canadian Pacific Railway Company's west coast steamer must be taken to Tofino village, near the entrance to Clayoquot sound, where transfer must be made to a launch to travel from the village to the head of Tofino inlet, about 22 miles distant. There is an excellent trail about 1½ miles long from the head of the inlet up Tofino creek, on the westerly side, to the *White* group, which is at an elevation of about 2,500 feet above sea-level.

Geology.—The country-rock on the *White* group appears to be chiefly granodiorite and diorite, but there are also rocks which belong to the Vancouver group of volcanic rocks, with interbedded beds of limestone similar to the country-rock classified by Dolmage as being observed by him in the Kennedy lake, south-easterly from the *White* group, and Bedwell sound and other points north-westerly from the group. There is a wide zone of this character of rock which can be traced in a north-westerly direction from Clayoquot arm of Kennedy lake to Tahsis canal, Nootka sound.

On the *White* group there are evidences of intrusions in the limestones of a rock similar to diorite, which have so intensely metamorphosed the limestone as to alter it to rocks containing garnet, epidote, pyroxene, quartz, tremolite, and actinolite. These contact-metamorphic rocks cover quite a large area on the *White* group, on a bench near the cabin, and have obliterated the definite line of the contact between the limestone and igneous rocks.

Ore-deposits.—There is much difficulty in determining the structure and extent of the ore-deposit on the *White* group, for the reason that there are several lenticular occurrences of high-grade chalcopyrite ore scattered over about an acre or more of a bench at an elevation of about 2,500 feet at the foot of a high mountain. This ore is closely associated with a belt of contact-metamorphic rocks containing garnet, epidote, quartz, some tremolite, pyroxene, and actinolite. The ore is found under the roots of trees and in many shallow holes sunk for prospecting-work. Apparently the ore is not in-place on the bench, but has possibly fallen from a fissure in the precipitous mountain-side in a northerly direction from the bench or terrace, and which overlooks it. Erosion has cut a channel between the vertical walls of the fissure, which is about 5 feet wide, striking in a true north-westerly direction. No solid ore is found in either of two adits driven into the mountain-side—one in the face of the fissure; the other about 25 feet lower elevation, driven close to the north-easterly wall, but to one side in order to avoid the stream of water that is continuously pouring over the face of the fissure. Contact-metamorphic rock is exposed in both of the adits, indicating the possibility of exposing ore at any time.

When it is considered that the mountain mentioned forms the comparatively narrow divide between Tofino and Tranquille creeks, also that on the Tranquille Creek slope copper-sulphide ore occurs in contact-metamorphic type of deposits striking north-westerly, it would appear to be advisable to prospect in that direction to determine whether there is any relationship between the occurrences of ore on the *White* group and those on the Tranquille Creek slope.

Development-work.—Since the *White* group was examined in 1919 there have been two adits driven into the mountain-side—one in the fissure, where falling water interfered with the work; the other at a lower elevation alongside of the fissure, so as to avoid the stream of water that flows between the walls during most of the year. The first-named adit is 15 feet long under cover, with an open-cut approach 10 feet long; the last-named adit is about 15 feet long.

Wanderer Group.

This group of two mineral claims, owned by L. C. Grant, of Tofino, is specially mentioned in Dolmage's summary report as being an illustration of gold-bearing quartz veins which constitute a type of mineral-deposit different from any previously described in connection with the west coast of Vancouver island. The group was visited by the writer on September 24th, 1921, in order to examine development-work recently done. In the Annual Report of the Minister of Mines for 1918, page 262, there is a full description of this group; consequently such will not be repeated here.

Development-work.—The new development-work consists of two short drift-adits in addition to open-cuts and stripping, by which the quartz vein is exposed for several hundred feet along its strike. The upper of the two adits is 10 feet long under cover, with an open-cut approach in solid rock 14 feet long; the lower adit is also 10 feet long under cover, but the open-cut approach made in solid rock is not as long as at the upper opening.

Samples and Assays.—Two samples taken from the vein in September last assayed: No. 1, gold, 0.10 oz.; silver, 0.4 oz. No. 2, gold, 0.20 oz.; silver, 0.06 oz. Samples taken by the writer in 1918 assayed: No. 1, gold, 0.32 oz.; silver, 0.4 oz. No. 2, gold, 0.64 oz.; silver, 0.8 oz.

While the quartz vein maintains its continuity with persistence, it remains very narrow, averaging only about 5 inches wide. On the other hand, its vertical extent up the mountain-side appears to be upward of 200 feet. It is possible that the width will increase in the vein above the elevation of the adits mentioned, in which event, if operations were carried on by a thoroughly experienced mining and expert millman, they might produce satisfactory results.

QUATSINO MINING DIVISION.

The mining industry in the Quatsino Mining Division has shown but little progress during 1921. The annual assessment-work has been done on mineral claims that have not been Crown-granted and some prospecting-work has been done by a few prospectors, chiefly those who reside near Holberg, at the head of the West arm of Quatsino sound, but there has been no new work of importance done.

Old Sport Group.

Work on this group of mineral claims, which was suspended in 1920 to await the erection of a concentrating-mill, has not been resumed, but it is expected that the Coast Copper Company, which is controlled by the Consolidated Mining and Smelting Company of Canada, will during the coming year build the proposed concentrating-mill and put the mine on a producing basis. In the meantime Wm. Clancy, the manager, and his assistant have been making a detailed geological survey of that section of the Quatsino Mining Division, in order, if possible, to determine the extent, structure, and relationship (if any) which the several outcroppings of copper-sulphide ore occurring in the district bear to each other. This work is in line with the prospecting-work that has been done by the engineers of the Consolidated Company in other portions of Vancouver island. It is said to be preliminary to the establishment of a copper-smelting plant on the Coast in the near future.

NANAIMO MINING DIVISION.

Placer-leases.

During 1921 there has been quite a revival in activity relative to securing placer-mining leases in the Nanaimo Mining Division, on the northernmost part of the coast of Vancouver island. Ten leases have been granted by the Gold Commissioner during the past year and several applications for leases made recently are pending. The ten leases granted are for areas in Townships 23, 24, 25, and 19, near Cape Sutil, a short distance westerly from the mouth of the Nahwitti river. The leases applied for are for areas in the vicinity of Fisherman bay, a few miles easterly from Cape Scott, the extreme north-westerly point on Vancouver island.

Ever since 1899, when placer gold was discovered associated with the black sand on the beach at Wreck bay, in the Clayoquot Mining Division, on the west coast of Vancouver island, also near Cape Sutil (then known as Cape Comerell), there have been intermittent efforts made by a few prospectors to create an excitement in favour of placer-mining along the beaches at several points on the west and north coasts of the island.

Several years ago some of the settlers at Cape Scott succeeded in securing small quantities of placer gold from the beach sands near Fisherman bay. The beach near the mouth of the Nahwitti river, as well as near Cape Sutil, was also repeatedly prospected, and small quantities of gold recovered at points where intensive concentration by wave-action has taken place. Whenever operations were attempted from the standpoint of a commercial proposition in the past they have invariably failed. The excuse generally made for these failures has been inability to save the fine flaky gold by using the ordinary methods.

It would appear that there have been two good reasons to account for these failures. The first is the fact that landings can only be made at irregular and infrequent intervals at the points referred to, which are on the open coast exposed to all winds and storms of the Pacific ocean. This causes expensive delays occasioned by loss of time. The second is the same reason why operations were abandoned at Wreck bay years ago, because the average quantity of gold in the black sand was too small to be extracted on a commercial scale, except where intensive concentration by wave-action had taken place, and such occurrences are very pockety, badly scattered, difficult to find, and after being worked over the first time are worked out.

Of course, it is possible that further systematic and thorough prospecting may result in the discovery of the source of the gold, but even then the gold-bearing quartz would have to carry sufficient value and occur in great enough extent to permit of mining operations being carried on successfully. It is hardly likely that any such discovery will be made at this late date, after many prospectors have expended energy and time searching for such source during the past twenty years, although, of course, as already stated, there is a possibility.

In the Nanaimo Mining Division the development of several prospects with promising possibilities has been continued during 1921, but the number of prospectors who make a business of exploring new sections in the mountain ranges in search of occurrences of minerals of economic value has been quite limited. With the exception of the parties of mining engineers sent into the field by the Consolidated Mining and Smelting Company, already referred to in this report, and whose activities were mainly directed towards the Nanaimo Mining Division, the writer failed to meet many other prospectors in that Division during the past season.

Nearly all of the month of July was devoted by the writer to a visit to Tatlayoko Lake and Klinaklini River sections, on the Mainland, in the extreme northerly part of the Nanaimo Mining Division, which owing to the lack of any trails from the Coast from either head of Bute or Knight

inlets can only be reached at the present time by travelling into the Chilcotin country and crossing the low summit between Chilko and Tatlayoko lakes.

The chief point of interest in this part of the Nanaimo Mining Division is that within its boundaries the easterly contact between those granitic rocks and the sedimentaries of the interior can be traced. This fact is also referred to by Wm. Fleet Robertson, Provincial Mineralogist, in his report on the Tatlayoko Lake section, published in the Annual Report of the Minister of Mines for 1910, in which he also draws attention to the possibilities of the section as a promising field for productive mineral-deposits to occur.

The writer during his trip examined the property of the Tatlayoko Lake Gold Mining Company, Limited, near the foot of Tatlayoko lake. At the headwaters of the Klinaklini river he examined the iron-ore property of the Hæmatite Mining Company.

Later in the season a trip was made to Siwash creek, near the head of Powell lake, where the *Copper Bowl* group of mineral claims was examined. Near Olsen Landing on Powell lake the mineral claims owned by George Kennedy and Jack Howse were examined. The *Ophir* and *Shamrock* mineral claims near Powell lake, about 3 miles from the Powell River pulp-mill, were also examined on this trip.

It is interesting to find that the ore-deposits on the properties mentioned in the Powell Lake section on Siwash creek occur in a zone of metamorphosed sedimentary rocks, one of the roof-pendants as described by Chas. Camsell and other geologists as occurring as inclusions in the granodiorite batholith of the Coast range. The values carried by the ore range from traces to 0.42 oz. in gold, from trace to 43.2 oz. in silver, and from 0.5 to 1.3 per cent. in copper.

On Texada island development-work has been done during 1921, which has been examined during the past season. This work has been chiefly confined to the *Marble Bay* mine, the *Nancy Bell* and *Marjorie* groups, and work done by John D. Edwards on a group of mineral claims near Gillies bay, Texada island.

On Quadra island development-work during 1921 has been confined to that done on the *Wanderer* and *Prospector* mineral claims near Deep Water bay, which were examined in June last. Samples from these claims assayed: Gold, trace; silver, 1.8 oz.; copper, 19 per cent.; and gold, trace; silver, 1.8 oz.; copper, 15.5 per cent.

From June 23rd to 26th was occupied in examining the *Silver Leaf* and *Mountain Ash* mineral claims, owned by Thos. Service, of Cowichan Lake. These are on a small creek, one of the headwaters of the Jump river, which flows into the South fork of the Nanaimo river. The interesting feature about this property is the values carried by the ore, which occurs in a well-defined vein in a shear-zone. The samples from the *Silver Leaf* claim assayed: Gold, 0.32, 0.66, 0.2, and 0.2 oz.; silver, 2.2, 2, 1.2, and 0.4 oz.; copper, 14.5, 3.7, 4.7, and 11.2 per cent. Samples taken in October by the owners from the same claim, after some development-work had been done, assayed: Gold, 0.80, 0.66, and 0.86 oz.; silver, 1.6, 1, and 1.4 oz.; copper, 5.5, 5, and 5.1 per cent.

TATLAYOKO LAKE SECTION.

Tatlayoko Lake Gold Mining Co.

The following is a report on the *Tatlayoko* group of six Crown-granted mineral claims, situated at an elevation of about 5,000 feet above sea-level on the easterly side of the narrow valley formed by the East fork of the Homathko river, about 6 miles from the southerly end of Tatlayoko lake, after an examination made by the writer during July, 1921. The Tatlayoko Lake section of the Nanaimo Mining Division is in the northernmost portion of that Division on the Mainland on the Coast watershed and near the easterly boundary of the Coast Range granodiorite batholith. The section has received but little attention from prospectors in the past, chiefly for the reason that it is inaccessible from the Coast, and the only route by which it can be reached at present is via Pacific Great Eastern Railway to Williams Lake; thence by automobile or horse-drawn wagon via Alexis Creek to the northerly end of Tatlayoko lake, a distance of about 150 miles.

The geology of a large portion of this section of the Nanaimo Mining Division is favourable for the occurrence of productive mineral-deposits, and if the section were more easy of access it would doubtless prove an attractive field for prospectors. The geologic conditions are described later in this report under the head of "Geology."

The only reports so far published on this section of the Nanaimo Mining Division are those in the Annual Reports of the Minister of Mines for 1910 and 1916; the former by the Provincial Mineralogist and the latter by John D. Galloway, the then Assistant Mineralogist.

The ore-deposits so far found in the Tatlayoko Lake section carry values in gold, silver, antimony, and sometimes copper, the mineralization being made up of iron pyrites, arsenopyrite, and antimony sulphide, with possibly some free gold.

The section is a fairly easy one to prospect, because the rock-exposures are frequent and extensive, especially above timber-line, which is at an elevation of about 5,000 feet above sea-level.

Area and Title.—The *Tatlayoko* group contains the *Tatlayoko*, *Tyee*, *Copper Dyke*, *Copper Dyke Extension*, *Isaac T.*, and *Spokane* mineral claims, which cover an area of approximately 300 acres. The claims are all Crown-granted and owned by the Tatlayoko Lake Mining Company, Limited; secretary, Matthew Sutton, 515 Dominion Building, Vancouver.

Geography.—The Tatlayoko Lake section of the Nanaimo Mining Division includes the area drained by the Tatlayoko lake, Matthew and Finnie creeks, and other branches of the Homathko river, on the Mainland of British Columbia, in the northernmost portion of the Division. The Homathko river is made up of two branches, the east and west, which form a junction a few miles southerly from the outlet of Tatlayoko lake and flow into the head of Bute inlet, one of the longest inlets penetrating the Mainland coast. The East fork of the Homathko river is the outlet of Tatlayoko lake, while the West fork has its source several miles north-westerly of that lake, in the range of mountains which forms the Coast watershed.

Geology.—The geology of the Tatlayoko Lake section has never been studied in detail so far as known to the writer. The report of J. D. Galloway, in the Minister of Mines' Report for 1916, affords evidence that, although he was limited as to time, he paid considerable attention to the geologic formations during his visit, and the Provincial Mineralogist, in the Annual Report for 1910, also briefly describes the more prominent features of the geology.

The writer observed particularly that a well-defined contact-zone occurs on and near the *Tatlayoko* group of mineral claims, between the Coast Range granodiorite batholith and the sedimentary rocks of the Interior plateau, with the granitic rocks occurring as intrusions into the older sedimentaries, which have consequently been so highly metamorphosed and altered as to be almost unrecognizable. The country-rock is also intruded by innumerable igneous dykes. A bed of conglomerate which is exposed between the upper and lower adits of the mine-workings is especially noticeable, and is particularly referred to by Galloway as follows:—

"It is probably a portion of the basal member of the sedimentaries series which is well exposed on the eastern side of Tatlayoko lake and includes the argillites and quartzites seen on this property. These rocks have been provisionally classified as representatives of the upper portion of the Hazelton formation, and from fossil evidence are placed as being of Lower Cretaceous age."

Ore-deposits.—Owing to the fact that the mine-workings had not been cleared out since work was suspended in the autumn of 1920, and that the argillite country-rock on the hanging-wall, which is very talcose next to the ore-body, the talc in places being 2 feet wide, had caved in many places along the drift portion of the upper adit, it was somewhat difficult to take samples without causing caving.

There are at least two well-defined persistent fissures on the *Tyee* and *Tatlayoko* mineral claims. These occur in a shear-zone in the metamorphosed sedimentaries in the near proximity to the intrusive granitic rocks of the batholith, and in the underground workings the upper or main vein in places is shown to occur at the contact of granitic and altered sedimentary rocks, with granite forming the foot-wall of the vein and argillite the hanging-wall. The general direction of the strike of the upper vein is N. 20° W. (mag.) and its dip at varying angles to the north-east.

There is a difference in elevation of about 150 feet between the upper or main vein and the lower, narrower vein. The strike of the lower vein is about N. 50° W. (mag.) and its dip, although in the same direction as that of the upper vein, is at a somewhat flatter angle.

The numerous dykes which outcrop on the surface do not appear to have interfered with the vein, except in one instance, where at the face of the upper adit, 367 feet from the portal, there occurs a dyke of apparently black igneous rock which cuts through the vein, so that in the face on July 15th, 1921, there was no ore exposed, but before reaching the dyke the vein is very persistent.

The portal of the upper adit is on the *Tyee* claim and is started in granite, and the adit is driven as a crosscut for 60 feet in a S. 50° E. (mag.) direction without intersecting the vein. At that point an upraise was made about 20 feet high and the vein exposed; consequently the

Morris's Camp, Chrominm Creek, Nanaimo M.D.

Car-ferry "Canora" at Nanaimo.

course of the adit was changed to easterly for about 30 feet, where the vein was exposed within argillite walls, on the adit level dipping about 40° to the north-east. From that point to the face the adit is driven as a drift along the strike of the vein in a general S. 20° E. direction a distance of nearly 300 feet, most of which distance is on the *Tatlayoko* claim. The vein is persistent but variable in width the entire distance. The width of the vein-filler, including the talcose gouge with the quartz-crushed rock gangue, varies from a few inches to the maximum width of 90 inches mentioned in the report of the Provincial Mineralogist in 1910 at the then face of the adit, 110 feet from the portal.

The underground workings on the lower vein were not examined, because the work had not been extended since the examination by Galloway in 1916, and owing to caving the adit was considerably blocked up. The outcroppings of both of the veins occur on the southerly side of a gulch in a very steep mountain-side about 300 or more feet above timber-line and at an elevation of nearly 6,000 feet above sea-level.

Samples and Assays.—The writer took six samples from the upper drift, which assayed as follows: No. 1, from across 6 inches near face: Gold, 0.14 oz.; silver, 1.5 oz. No. 2, from across 8 inches, 50 feet from face: Gold, 0.06 oz.; silver, 0.6 oz. No. 3, from across 6 inches, 50 feet from No. 2: Gold, 0.6 oz.; silver, 1.2 oz. No. 4, front across 6 inches, 45 feet from No. 3: Gold, 0.76 oz.; silver, 5.5 oz. No. 5, from across 10 inches, 50 feet from No. 4: Gold, 0.36 oz.; silver, 3.7 oz. No. 6, selected samples for antimony: Gold, 0.12 oz.; silver, 2.7 oz.; antimony, 43 per cent.

Galloway reports in 1916 samples and assays as follows: No. 1, across 6 inches at point 15 feet from face: Gold, 0.08 oz.; silver, 0.8 oz. No. 2, across 18 inches at point 170 feet from face: Gold, 0.50 oz.; silver, 10.3 oz. This No. 2 sample would represent sampling between Nos. 4 and 5 in first list. No. 3, across 18 inches at point 100 feet in from portal: Gold, 0.08 oz.; silver, 0.9 oz. No. 4, picked specimen from dump showing high percentage of antimony with gold: Gold, 0.02 oz.; silver, 4.2 oz. Galloway's No. 3 sample was evidently taken near the point where the vein is first exposed on the adit level.

The Provincial Mineralogist's samples taken in 1910 are reported as follows: No. 1, rough sample of outcrop of upper vein assayed: Gold, 3.50 oz.; silver, $26 to the ton. No. 2, from across about 12 inches in raise 18 feet high at end of crosscut, part of adit where vein is first exposed: Gold, 0.28 oz.; silver, 2.60 oz.

"At the face of the tunnel (then 110 feet from portal) the whole drift was in ore, and apparently has not disclosed the full width of the ore-body. What was considered the 'hanging-wall' was quartz which I had sampled, and it assayed: Gold, $8; silver, 16 oz. to the ton. Below this the vein was exposed for a width of 90 inches, which I sampled in three parts of 30 inches each, and assayed as follows: Thirty inches next hanging-wall: Gold, trace; silver, 0.4 oz. Thirty inches middle of vein: Gold, 0.14 oz.; silver, 1.0 oz. Thirty inches bottom of vein: Gold, 0.20 oz.; silver, 30.4 oz.

"The lower 30 inches of the exposure in the face of the tunnel contains a considerable percentage of sulphide of antimony; this part of the vein continued into the floor of the tunnel for a depth not determined, so that the 30 inches sampled does not represent the full thickness of this grade of ore."

Development-work.—During the past year the development-work on the property has been almost exclusively confined to the following: Construction of a good wagon-road, with the necessary bridges across tributaries of the East fork of the Homathko river, to connect the south end of Tatlayoko lake with a new sawmill about 2 miles from the foot of the mountain in which the ore-deposits occur; construction of a new horse-trail from near the sawmill to the mine-workings, a distance of about 4 miles; developing water-power on Finnie creek and constructing ditch and flume to sawmill-site; constructing sawmill with capacity to cut about 3,000 feet board measure daily.

The development-work in the mine-workings is confined principally to the *Tyee* and *Tatlayoko* mineral claims and consists of two adits. The upper adit is 370 feet in length and the lower one 250 feet in length. There are two raises from the upper adit; one at a point 60 feet from the portal is 18 feet high; the other at a point 50 feet from the face of the adit is 20 feet high.

KLINAKLINI RIVER SECTION.

The Klinaklini River section was visited by J. D. Galloway in 1916 when he was Assistant Provincial Mineralogist. He reached the headwaters of the Klinaklini river while on a trip from Bella Coola to Alexis Creek, in the Chilcotin country, and en route examined the groups of mineral claims on Chromium creek, the headwaters of the Klinaklini river, owned by the Hæmatite Mining Company. The writer in July last examined the same property, but reached the headwaters of the Klinaklini river from the east after passing the old Ben Franklin ranch on Tatla lake on his return trip from Tatlayoko lake. In Galloway's report, pages 166-168 of the Report of the Minister of Mines for 1916, he has described the geology and general characteristics of this section of the Nanaimo Mining Division quite fully, so that it is unnecessary to repeat such in this report.

The Klinaklini river is a stream several miles long; its course is very circuitous; its headwaters are made up from the junction of Chromium creek with two small tributaries which head in the easterly slope of the Coast range at an elevation of about 6,500 feet above sea-level. The main stream from below the junction of these creeks is called the Klinaklini river, which flows south-easterly through Render or Miners lake; then easterly a few miles to a wide valley known as Klinaklini flats, where the course changes to a westerly direction for about 5 miles. The river then flows through Pat McClinchey's ranch, beyond which it widens and forms One Eye lake. The lake is about 6 miles long and its valley is wide ranch land to its foot, where is located the Klinaklini telegraph-office at Sam Colwell's ranch. From the ranch the course of the river is in a general south-westerly direction through the Coast range to the salt water at the head of Knight inlet. Autos can be used on the wagon-road the entire distance from Alexis Creek to One Eye lake.

Haematite Mining Co.

The property known as that belonging to the Hæmatite Mining Company comprises a large group of mineral claims located at the head of Chromium creek, near the base and on the westerly slope of Perkins peak, the most prominent landmark in that section and the highest peak in that portion of the Coast range. Perkins peak reaches an elevation of nearly 10,000 feet above sea-level. The group of claims occupies the whole of the glacial cirque at the head of Chromium creek and the boundaries extend down that creek on both banks for a very considerable distance, there having been about seventy claims staked during 1920, in addition to the thirteen held in 1916 when Galloway made his examination. The entire group of claims is about 1,000 feet above timber-line, which fact led to the construction of a large rock cabin for a mine camp at a point far enough down the creek as to be considered beyond the danger-line from either snow or rock slides.

Geology.—The Hæmatite group of mineral claims is reached by travelling a pack-trail through the mountains for about 20 miles in a general south-westerly direction from One Eye lake to the base of Perkins peak at the head of Chromium creek, where the creek forms a wide deep gulch, with increasing width below the glacier at its source. The mountains on three sides are high, with precipitous slopes covered with slide-rock to a depth that is undetermined. A considerable proportion of these slides is made up of float iron ore in pieces varying in size from gravel to large lumps.

The country-rock in the vicinity of the group of claims is chiefly argillite, which has in many places been intruded by the granitic rocks of the Coast Range. The zone of contact between the granitic rocks and the older sedimentaries and volcanics is fairly well defined in the locality of the occurrence of the iron-ore deposits which Galloway considers are of contact-metamorphic origin.

Ore-deposits.—It is very difficult to form any opinion as to the extent of the deposits of hæmatite-iron ore, because, although several open-cuts have been made across the mineralized zone, none of these were deep enough to expose bed-rock, so that the only opinion that could be formed as to quantity of ore is from an estimate of the proportions of ore and country-rock in the dumps and along the walls of the open-cuts. Such an estimate could not be considered at the time of the writer's visit, because all of the cuts had been made previous to Galloway's examination in 1916 and were more less filled with slide-rock that would require the steady work of four or five men for weeks to remove.

The only development-work besides the open-cuts is a crosscut adit described by Galloway as being 600 feet long, but which in 1921 could not be examined because its caved condition made it impossible to enter it.

Samples and Assays—Although it was not possible to take any samples from "ore in-place" owing to the conditions of the workings, one general sample and one selected were taken from dumps. These assayed: General: Iron, 48.9 per cent.; phosphorus, trace; sulphur, trace; silica, 30.7 per cent. Selected: Iron, 57.6 per cent.; phosphorus, 0.24 per cent.; sulphur, trace, silica, 15.6 per cent.

Galloway's samples assayed:—No. 1: Iron, 47.6 per cent.; phosphorus, trace; sulphur, *nil*. No. 2: Iron, 48.4 per cent.: phosphorus, trace; sulphur, *nil*. Selected ore: Iron, 57 per cent.; phosphorus, trace; sulphur, *nil*.

Conclusions.—It would appear as though under existing circumstances with regard to transportation facilities it is inadvisable to consider that the Klinaklini iron-ore deposits in themselves have any present commercial value, but that the evidences of mineralization are so pronounced and cover such a large area, not being merely confined to the Chromium Creek deposits, as to make the section quite attractive to prospectors searching for other minerals than iron ore.

In the event of other discoveries being made in the zone of contact represented in the section, such might develop into mines having sufficient commercial value to warrant the improvement of the transportation facilities to a point where the iron ore could be mined profitably. There is no question but that the quality is such as would make it an extremely popular supply for manufacture into iron or steel products.

Powell Lake Section.

Copper Bowl Group.

This group contains thirty-five mineral claims situated on and near the summit of the Coast range of mountains, between Powell lake and Theodosia arm of Malaspina inlet, about 80 miles from the city of Vancouver. The discovery of the occurrence of ore near the summit was made by Oswell Stevenson, of Powell lake, during a hunting-trip after mountain-goat. The geology of this interior section tributary to Powell lake has never been studied by any members of the Geological Survey of Canada. Along the Mainland coast-line the geology was examined by J. Austen Bancroft, whose report is published as Memoir No. 23, "Geology of the Coast and Islands between the Strait of Georgia and Queen Charlotte Sound, B.C.," Canada Department of Mines, Geological Survey Branch, 1913.

Powell lake is about 20 miles long, breaking through the Coast range of mountains from Powell river, locally called Goat river, from which the lake is fed, in a south-westerly direction, and having its outlet at Powell River falls, the power plant for a large pulp-mill. For the most part the mountains rise precipitously from the lake-shores to considerable elevations, though an exception to this rule is found at the mouth of Olsen river, which flows through a fairly wide valley, known as Olsen valley, into the westerly side of the lake about 10 miles from its outlet. In this valley there are several settlers who are cultivating farms along the Olsen river where the timber has been logged off, and they are apparently prosperous.

This discovery of the outcroppings of ore-deposits at and near the summit of the Coast range in this section furnishes another instance of the occurrence of a belt of metamorphosed stratified rocks which remain to-day as remnants of the roof which once covered the intrusive rocks of the batholith. The theory advanced by Bancroft, that where such ore-deposits occur in the roof-pendants they will be found up towards the tops of the mountains rather than at the lower levels, is proven to be correct with regard to the occurrences of ore not only on the *Copper Bowl* group of mineral claims, but also at other points in the Coast Range batholith. Prospectors who have during the past three or four years been searching for such occurrences have found out that to be successful their work must be done at the higher altitudes, because it is very seldom that any outcroppings of ore-deposits occur at lower levels.

Area and Title.—The *Copper Bowl* group contains thirty-five mineral claims, which cover an area of approximately 1,700 acres. The title to this group is held by Oswell Stevenson, A. L. Gilfillan, Mrs. M. Berry, Mondef Anderson, Robert Polsin, and W. Simmons, who form a syndicate, for which A. L. Gilfillan, Room No. 5, Williams Building, Vancouver, is trustee.

Geography.—The *Copper Bowl* group of mineral claims is in the Mainland portion of the Nanaimo Mining Division, in the Coast range between Theodosia arm of Malaspina inlet and the head of Siwash creek, which flows into Powell lake, on the westerly side of the lake, about 16 miles above its outlet. The property is about 80 miles distant from Vancouver and is reached at present by steamer to Powell River pulp-mills; thence transfer to foot of Powell lake by

auto; from there by launch to the mouth of Siwash creek, and on foot up Siwash creek, where there is only a very poor trail, to near the head of the creek at the foot of the mountain on which the group of mineral claims is located. An alternative route by which the property could be reached is by steamer to Theodosia arm of Malaspina inlet; thence through the woods to the claims; but before this route, which is the most direct, can be travelled as a pack-trail, it is necessary to cruise out and construct a trail from the shore to the claims.

Geology.—The mountains in the vicinity of Theodosia arm, as well as Powell lake, appear to have attractive features for prospecting, for the reason that at some points along the shore of the arm there are outcroppings of greenstones of the Valdes group of volcanic rocks, argillites, and quartzites, indicating the occurrence of belts of roof-pendants, with possibly ore-deposits. The presence of these rock formations, when considered with the outcroppings of ore-deposits at and near the summits of the mountain range between Theodosia arm and Powell lake, which occur in a similar rock formation, suggests the advisability of more thorough prospecting than has been done in the past.

Siwash creek, which was followed to reach the *Copper Bowl* group, from near its mouth on Powell lake for a distance of about 5 miles to within a short distance of its head is a torrential stream that flows in a general south-easterly direction, following the general line of strike of the altered sedimentaries. The grade of the creek-bed is very steep. The only rock formation observed near the creek is the granodiorite of the Coast range, but after climbing up a huge rock-slide that reaches to about 900 feet vertical height above the bed of Siwash creek, a contact is noticeable between the granodiorite and metamorphosed argillites and quartzites with the granodiorite on the easterly side of the altered sedimentaries. This contact is exposed in a deep, narrow, precipitous gulch in the mountain-side which extends from the summit down to the top of the rock-slide already referred to, and apparently follows the line of strike of the contact. The rocks are much sheared and fractured, indicating a shear-zone at the contact of considerable width. A stream of water was flowing down the contact-metamorphic rocks, where ore-outcroppings occur, at the time of examination, and this as well as the steepness of the gulch-bed interfered with the work, for the reason that there was no method to turn the water from the gulch and no rope to assist in climbing up the precipitous face of the gulch.

The occurrence of the metamorphosed sedimentaries in contact with the grandiorite was first observed above the top of the rock-slide at an elevation of about 3,000 feet above sea-level. From there the zone of the roof-pendant rocks appears to extend to the extreme summit of the mountain range and on to the opposite slope facing Theodosia arm, but not sufficient prospecting has been done to establish the continuity.

Ore-deposits.—The ore-deposits on the *Copper Bowl* group of mineral claims occur in a shear-zone of metamorphosed sedimentaries made up of argillites and quartzites at the contact between those rocks and granodiorite of the Coast Range batholith. The apparent strike of the belt of altered sedimentaries is north-westerly and the dip nearly vertical, but these data are not yet fully determined, neither is the extent of the ore-deposits, for the reason that there has not been sufficient prospecting or development work done. The shear-zone can be traced up towards the mountain summit by climbing up a deep, precipitous, narrow gulch from a point about 200 feet above the top of a huge rock-slide, about 900 feet vertical height above the bed of Siwash creek, where a few shots have exposed quartz carrying pyrite, arsenopyrite, a little galena, and chalcopyrite in a fissure. At the point where the mineralized quartz is first observed it appears to be narrow.

About 300 feet higher than the point just referred to more extensive outcroppings of sulphide ore occur, in which the mineralization is made up chiefly of pyrite, arsenopyrite, and chalcopyrite in a gangue composed of quartz and crushed country-rock. This occurrence is at a point on the mountain-side where a shelf or basin has been formed, and is an indication that continuity of the zone of metaorphosed sedimentaries is maintained, and suggests that more thorough prospecting-work is desirable in order to determine continuity and extent.

Samples and Assays.—A sample from the ledge-matter at the lowest point above the big rock-slide, where mineralization is observed, assayed: Gold, 0.20 oz.; silver, 43.2 oz.; copper, 0.5 per cent. The following are the assay results from samples taken in the basin or shelf about 300 feet higher elevation than the point just referred to: No. 1, from easterly end of shelf: Gold, trace; silver, 1.2 oz.; copper, 0.7 per cent. No. 2, from 15 feet from No. 1: Gold, 0.42 oz.; silver, 13.5 oz.; copper, 1 per cent. No. 3, from 20 feet from No. 2: Gold, trace; silver, 1.8 oz.; copper,

1.3 per cent. No. 4, from 15 feet from No. 3: Gold, trace; silver, trace; copper, 0.7 per cent. No. 5, from 15 feet from No. 4: Gold, 0.04 oz.; silver, 0.4 oz.; copper, 1 per cent. No. 6, from 30 feet from No. 5: Gold, trace; silver, 0.2 oz.; copper, 0.5 per cent.

Development-work.—The development-work on the *Copper Bowl* group of mineral claims is practically confined to surface-stripping and open-cuts preparatory to selecting the most desirable point at which to start a systematic method of general underground development.

Mayflower Group.

This group is in the Nanaimo Mining Division and contains two mineral claims, the *Mayflower* and *May*, owned by George Kennedy and Jack Howse, Foch Post-office, Powell lake. The group was examined on August 11th, 1921. The *Mayflower* group is in the mountains on the northerly side of the wide valley drained by Olsen river, which flows into Powell lake on the westerly side about 10 miles from the outlet. The timber in Olsen valley has been logged off for some years and several settlers are successfully farming on the land. The valley is about 4 miles long from the landing on Powell lake to Olsen lake, at the head of the valley. The mountains on both the north and south sides of the valley are high and rugged.

The mineral claims are reached by travelling a good road for about 3 miles from Olsen Landing to near the mouth of a small unnamed creek that flows from the mountains through a deep canyon about a mile from the wagon-road. The elevation of the mine-workings is about 2,000 feet above sea-level, and from the cabin salt water in Theodosia arm of Malaspina inlet can be seen.

Geology.—The country-rock on the *Mayflower* group of mineral claims is made up chiefly of metamorphosed sedimentaries, limestone, and intrusive granitic rocks of the Coast Range batholith, evidently another instance of the occurrence of a zone of undestroyed roof-pendants. Associated with the altered limestone there are bodies of such contact-metamorphic minerals as hornblende, epidote, and garnet, also occurrences of pyrrhotite, iron pyrites, and some chalcopyrite.

Ore-deposits.—There are three outcroppings of contact-metamorphic minerals, made up principally of hornblende, pyrrhotite, iron pyrites, epidote, and garnet, with some chalcopyrite, that are exposed in the deep canyon near the head of the small creek referred to. These outcroppings have apparently been crosscut by the canyon. They are exposed in each case for about 7 or 8 feet wide, but apparently are not continuous for any considerable depth. In two adits driven to develop the deposits at depth the results have not been satisfactory, as no ore carrying values is exposed in the upper adit, and in the lower one it looks as though the only occurrence of ore has been crosscut at the portal of the adit.

Samples and Assays.—Two samples were taken—one from the face of the No. 1 or upper adit; the other from the dump of pyrrhotite at the portal of the No. 2 or lower adit. The first of these samples assayed traces only in gold, silver, and copper; the second sample assayed: Gold, *nil*; silver, *nil;* copper, 3.7 per cent.

Development-work.—There are two adits which have been driven into the wall of the canyon; these are known as No. 1 or upper adit and No. 2 or lower adit, the lower one being about 300 feet down the canyon from the upper and at about 70 or 80 feet lower elevation. The No. 1 adit is 72 feet long, driven in a north-westerly (mag.) direction; No. 2 adit is 38 feet long, also driven in a north-westerly (mag.) direction. There is also an open-cut approach 15 feet long to the No. 2 adit.

Ophir Group.

This group was examined on August 12th, 1921. It contains two mineral claims recorded as the *Ophir* and *Shamrock*, owned by J. Shearman; post-office address, Powell River. The *Ophir* group of mineral claims is on Copper creek, a small stream flowing in an easterly direction into the north side of Powell lake, about 3 miles above its outlet near the Powell River paper-mills. The *Shamrock* mineral claim is on the northerly side of Copper creek and the *Ophir* claim on the southerly side of the creek adjoining the *Shamrock*, but with its westerly boundary a short distance westerly from that end of the *Shamrock* claim.

Geology.—The country-rock on the *Ophir* group of mineral claims resembles diorite, which is considerably sheared and fractured. In the shear-zone there occurs a system of fissuring, and one of these fissures on the *Shamrock* claim is filled with breccia and quartz, the quartz portion of the vein-filler being about 7 feet wide. The line of strike of the fissure is north-easterly and dip 45° to the north-west (mag.). The vein-filler is mineralized with particles of galena, chalcopyrite, and iron pyrites disseminated irregularly through the quartz and breccia.

Ore-deposits.—The deposit or vein of ore on the *Shamrock* claim has not been developed to a sufficient extent to determine many facts relative to its length or width, the latter measurement only having been shown at one point underground where in the face of a crosscut adit the portion of the fissure filled with quartz is 7 feet wide, sparsely mineralized, but not enough so as to warrant shipping as ore. The deposit does appear to have sufficient indications of carrying enough values to make it an ideal concentrating proposition, especially when it is considered that Copper creek carries sufficient water for concentrating purposes.

Samples and Assays.—No samples were taken during the examination, but in 1917 a sample of sorted ore taken by the writer of this report assayed: Gold, 0.2 oz.; silver, 9.8 oz.; copper, 1.9 per cent. A grab sample assayed: Gold, 0.02 oz.; silver, 1.8 oz.; copper, 1.1 per cent.

Development-work.—The development-work consists of a wide open-cut approach 12 feet long to a crosscut adit 27 feet long driven in a N. 50° W. (mag.) direction.

On the *Ophir* claim of the group the conditions with regard to the geology and ore-deposits are very similar to those on the *Shamrock* claim; in fact, it appears as though the ore-deposit extended on to the ground occupied by the *Ophir* claim, but the dip of the fissure is much flatter than on the *Shamrock* claim and in the opposite direction. The outcroppings of mineralized vein material on the *Ophir* claim are at a somewhat higher elevation than those on the *Shamrock* claim and have been developed less. The development-work on the *Ophir* is represented by two large open-cuts.

Strathcona Park Section.

Paramount Mining Co.

The *Lynx*, *Pair*, and *Shot* groups of mineral claims on Myra and Price creeks, which flow into Buttle lake near its head, are owned by the Paramount Mining Company; Joseph Errington, of San Francisco, managing director. In the Annual Report of the Minister of Mines for 1920, pages 207 and 208, these groups of mineral claims were fully described. During 1921 the systematic prospecting-work that was carried on during the previous year has been continued, and Crown grants have been applied for with regard to several of the claims contained in the groups.

Texada Island Section.

The mining industry on Texada island has not been as active during 1921 as in previous years owing to the closing-down of the *Marble Bay* mine, which has been a regular shipper of copper-gold ore carrying values in excess of the usual averages contained in the ores from copper-mines in the Coast District.

The prospecting-work done by diamond-drilling during 1920 below the 1,600-foot level had exposed an ore-body at a lower level than had heretofore been prospected, and nearly under the ore-body mined from the 1,600-foot stope, and arrangements were being made to continue sinking the winze from the 1,600-foot level, and to drift on the newly discovered ore-body to determine its extent preliminary to stoping.

The slump in copper took place about the same time, so the management decided to close all work down until the copper market recovered sufficiently to guarantee profitable operations.

The ore-body exposed by the drill-holes was quite promising, and the assays from the drill-cores showed about the same values as the average shipments of first-class ore have carried in the past.

Owing to the closing-down of the *Marble Bay* mine the only production from Texada island during 1921 was a limited tonnage of magnetite-iron ore from the *Good Hope* mineral claim on Raven bay, also of limestone from the quarries on Sturt (Marble) bay and on Blubber bay, at the north-westerly end of the island.

Development-work has been done during 1921 on the *Marjorie*, *Nancy Bell*, and *Sentinel* groups of mineral claims, also by John D. Edwards on his group of claims near Gillies bay.

Marjorie Group.

This group, which contains the *Marjorie*, *Fairview*, *Wild*, *Saga*, and *Texas Fraction* mineral claims, was bonded in 1921 by Jack McConville, of Vananda, and partners, who extended the development-work done in the past, and when an examination was made by the writer on May 29th, 1921, were preparing to build a mill and concentrating plant near the mine-workings. As the *Marjorie* group was fully described in the Annual Report of the Minister of Mines for 1916, it is unnecessary to repeat the description in the present report. The ore-deposits on the *Marjorie* group are a system of quartz veins occurring in porphyrite country-rock not far from its contact with the Marble Bay limestone.

The values carried by the quartz-vein filler are quite erratic, as shown by the assays of three samples taken during the examination. No. 1, from a prospect-hole on a quartz vein about 220 feet north-westerly from the main shaft, assayed: Gold, trace; silver, trace. No. 2, from same prospect-hole, assayed: Gold, *nil;* silver, *nil.* No. 3, from pay-shoot about 4 inches wide from drift from the main shaft, assayed: Gold, 4.5 oz.; silver, 0.5 oz. The vein-filler at the point sampled consists of quartz 13 inches wide, gouge about ¼ inch wide, and crushed country-rock and quartz about 24 inches wide.

Nancy Bell Group.

This group contains three Crown-granted mineral claims, designated as Land Lots Nos. 44, 46, and 105, owned by Wm. Lee and Wm. McDonald, of Vananda and Hugh McMillan, of Nanaimo. The property was examined on May 30th, 1921. That part of the *Nancy Bell* group of mineral claims designated as Land Lot No. 44, originally known as the *Silver Tip* mineral claim, has a history extending back to 1897, when James Findlay, of Vancouver, acting for a St. John, New Brunswick, syndicate, developed it by sinking two shafts on the strike of a fissure-zone in porphyrite country-rock. One of the shafts is 145 feet deep; the other 150 feet, with an interval of 200 feet between them. Some drifting was also done from the bottom of the last-named shaft, also from a station at the 50-foot level. About 1900 all work was suspended; later the buildings erected for a camp were destroyed by fire. Since then, until last year, there has been no activity on the *Silver Tip* mineral claim.

During the past year the *Silver Tip* (Land Lot No. 44), *Nancy Bell* (Land Lot No. 46), and the *Thyee* (Land Lot No. 105) mineral claims have been consolidated under the ownership before mentioned and development-work has been progressing, superintended by Wm. Lee, who has since 1875 acted as local manager for the Puget Sound Iron Company, owners of all of the magnetite-deposits on the west coast of Texada island.

Geography.—The *Nancy Bell* group of mineral claims is in the north-westerly portion of Texada island, near the northerly base of Surprise mountain and about a mile easterly from Davis bay. The group is reached by travelling the Vananda–Iron Mines wagon-road to its junction with the road from Kirk lake; thence westerly about a mile to the *Silver Tip*, *Nancy Bell*, and *Thyee* mineral claims, which adjoin each other, except that there is a small land lot (No. 45) between the *Silver Tip* and *Thyee* mineral claims. The *Thyee* claim is north-westerly from the *Silver Tip* and the *Nancy Bell* southerly from the *Silver Tip*.

Geology.—The country-rock on the *Nancy Bell* group is porphyrite, which contacts with the Marble Bay limestone about a mile easterly from the *Silver Tip* and *Nancy Bell* claims. According to McConnell's geological map of Texada island, the porphyrite country-rock occurs in a vast mass covering all of the area northerly from Welcome bay to Crescent bay and easterly beyond Spectacle lake and Priest lake to the west side of Emily lake. In this portion of Texada island, especially on the *Nancy Bell* group, occurs a network of quartz veins and silicified fissure-zones which cut the porphyrite country-rock.

Ore-deposits.—The ore-deposits on the *Nancy Bell* group occur as quartz veins in one of the fissure-zones described by McConnell. These veins are quite numerous, they vary in width from 6 inches to 3 feet, and appear to be confined to one wide fissure-zone which strikes in a general north-westerly direction, but sometimes the strike of some of the quartz veins varies from north-westerly to westerly. The fissure-zone is apparently continuous for several hundred feet, extending through the entire group of mineral claims.

The development-work had not been sufficient up to the date of the examination to determine many material facts relative to the length of the various quartz veins or the depth to which they maintained continuity. The dips vary from 64° to the southerly to almost vertical. The gangue is quartz; the walls are well defined, with gouge usually on both walls and always on one.

The mineralization of the vein-filler is very similar in all of the quartz veins, being made up of iron pyrite, galena, zinc-blende, and some free gold.

Samples and Assays.—Several samples were taken from the several open-cuts, but the shafts could not be sampled owing to the quantity of water in them. The samples assayed as follows:—No. 1: Gold, 0.24 oz.; silver, 0.8 oz. No. 2: Gold, 0.4 oz.; silver, 3.5 oz.; zinc, 13 per cent. No. 3: Gold, 1.4 oz.; silver, 0.6 oz.; zinc, 0.5 per cent. No. 4: Gold, 0.82 oz.; silver, 0.4 oz.; zinc, 0.5 per cent.; copper, 1.2 per cent. No. 5: Gold, 0.4 oz.; silver, 0.04 oz.; zinc, 0.5 per cent.

Since taking the above-mentioned samples the writer is advised by Mr. Lee, the superintendent, that in extending the development-work on the *Nancy Bell* mineral claim, assay results

from his samples show higher values in gold than the samples taken at the time of the examination on which this report is based.

Development-work.—Since resuming work on the *Nancy Bell* group, up to the time of the examination, the work done had been principally prospecting along the strike of the fissure-zone from near the easterly end of the *Nancy Bell* claim to the north-westerly end of the *Thyee* claim. There are seven open-cuts varying from about 10 to 18 feet long, a crosscut adit 60 feet long, and several prospect-holes, each about 6 to 8 feet deep. Since the examination was made the writer is advised that work has been continued and a shaft sunk on the *Nancy Bell* claim.

Sentinel Group. This group, which was examined on May 31st, 1921, contains two mineral claims—the *Sentinel* and *Red Wing*—and is owned by Robert Swan, of Vananda. The *Sentinel* group is near the centre of Texada island, a short distance southerly from the Vananda–Gillies Bay wagon-road and northerly from Paxton lake.

Geology.—The country-rock on the *Sentinel* group is crystalline limestone, classified by McConnell as "Marble Bay" limestone, but the contact between that rock and porphyrite is in the near vicinity. The limestone is very much fissured and is traversed occasionally by diorite—porphyrite dykes.

Ore-deposits.—McConnell refers to the ore-deposits on the *Sentinel* group in the following language in Memoir No. 58, "Texada Island, B.C.," published by Canada Department of Mines, Geological Survey, 1914: "The mineral-deposits at the *Sentinel* differ from the ordinary types prevalent on the island. They consist of iron and copper pyrites, galena, tetrahedrite, and blend in grains, small aggregates, and veinlets scattered irregularly in small quantities through a wide band of the fissured and broken limestone. The ordinary contact-metamorphic minerals, with the exception of calcite and quartz, are almost entirely absent."

Quadra Island Section.

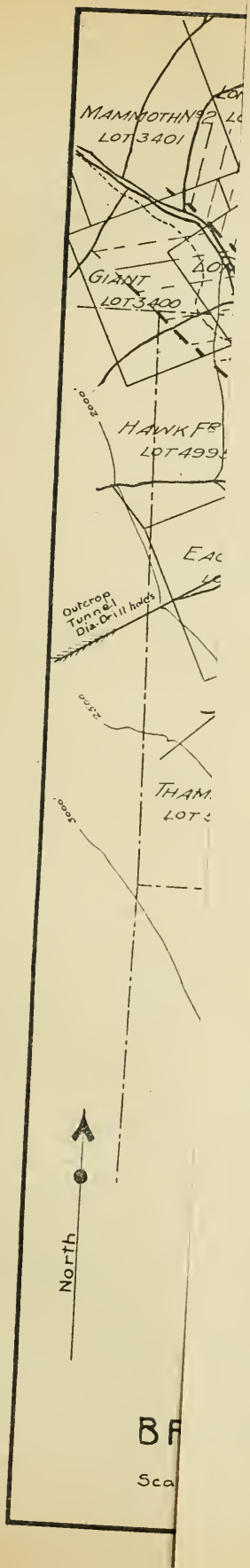
In the Quadra Island section of the Nanaimo Mining Division there has been but little activity during 1921. The expected resumption of development-work and shipments from the *Ingersoll* group of Crown-granted mineral claims were postponed, as was also the further development of the groups near Bold point, on the easterly side of the island, and Granite bay, on the westerly side. In fact, the only activity was in the vicinity of Deep Water bay, on the westerly side of the island, and Heriot bay, on the easterly side. The *Wanderer* group near Deep Water bay and the *Dawn* group near Heriot bay were examined on June 17th and 19th, and as these have never before been reported on, the following reports are included here:—

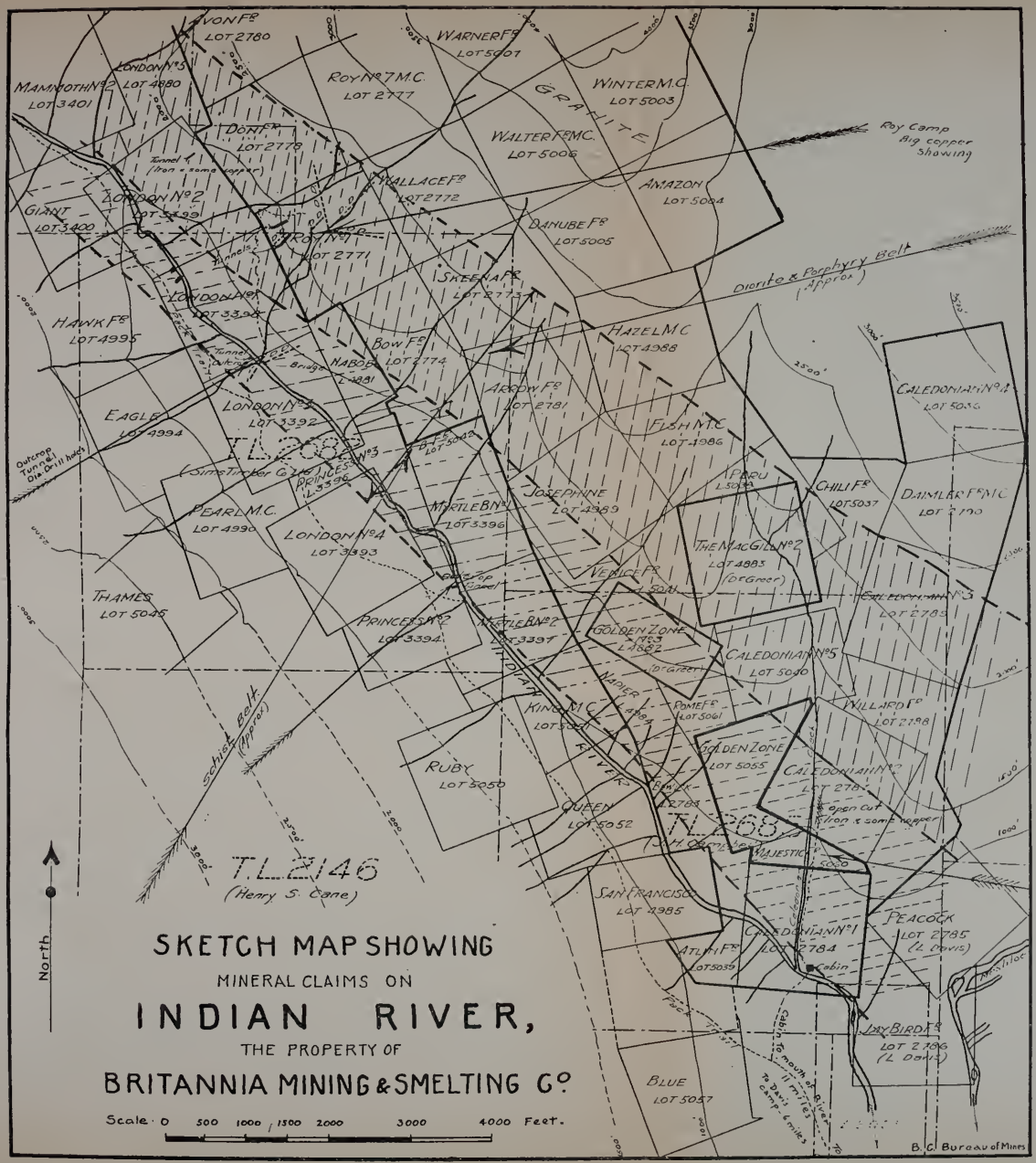
Wanderer Group. This group contains the *Wanderer* and *Prospector* mineral claims, owned by Albert Ross and Edward Hamilton; address, Granite Bay, Quadra Island. The group is about 1¼ miles easterly from Deep Water bay, near the head of a small creek which has a very steep fall and flows between high, almost precipitous, banks. Deep Water bay is a short distance northerly from Seymour narrows, where navigation is extremely hazardous for launches and small boats because of the rapid flow of the tides, the tide-rips, and whirlpools. In Deep Water bay there is fairly good shelter for light-draught vessels, as there also is in the other harbours on the westerly coast of Quadra island, such as Granite bay, Gowlland harbour, and Quathiaski cove. On the easterly coast of Quadra island the safest shelter is in Heriot bay, but there is also fairly good shelter for small boats in the cove near Bold point and in Hyacinth bay.

The *Wanderer* group of mineral claims is at present reached by the wagon-road (old logging-railway) from Granite bay about 3 miles long; then by trail about 3 miles, there being no trail from Deep Water bay. The writer walked to the groups from Deep Water bay through timber in order to observe the feasibility of constructing a trail by that route, about 1¼ miles long, and so avoid travelling the route from Granite bay, about 6 miles long, but very much easier travelling.

Geology.—The country-rock in the near vicinity of the *Wanderer* group is the volcanic rock typical of the formation of the greater part of Quadra island, but the limestone-belt, which is of considerable width and is continuous across the island from Open bay, on the easterly side, to near Granite bay, on the westerly, contacts with the volcanics not a great distance from the ore-body on the *Wanderer* group.

Ore-deposits.—Copper-sulphide ore occurs on the *Wanderer* mineral claim, on which all the development-work has been so far done, in a fissure in a shear-zone in the volcanics. The


MAMMOTH No 2
LOT 3401
GIANT
LOT 3400
HANK FR
Outcrop
Tunnel
Dia. Drill holes
THAM
North


VON Fr
LOT 2780
WARNER Fr
LOT 5007
LONDON No 5
LOT 4980
MAMMOTH No 3
LOT 3401
ROY No 7 M.C.
LOT 2777
WINTER M.C.
LOT 5003
GRANITE
DON Fr
LOT 2778
WALTER Fr M.C.
LOT 5006
Roy Camp
Big copper
Showing
Tunnel 1
(iron + some copper)
WALLACE Fr
LOT 2772
AMAZON
LOT 5004
LONDON No 2
LOT 3391
GIANT
LOT 3400
DANUBE Fr
LOT 5005
LONDON No 1
LOT 2771
Diorite & Porphyry Belt
(Approx)
SKEENA Fr
LOT 2773
LONDON No 4
LOT 3394
HAZEL M.C.
LOT 4988
HAWK Fr
LOT 4995
BOW Fr
LOT 2774
NABOB
L 1881
CALEDONIA No 4
LOT 5056
ARROW Fr
LOT 2781
LONDON No 3
LOT 3392
EAGLE
LOT 4994
FISH M.C.
LOT 4986
PARU
L 5043
CHILI Fr
LOT 5037
DAIMLER Fr M.C.
LOT 2790
T.L. 2088
(Similkameen Placer Claim)
PRINCESS No 3
L 3396
Outcrop
Tunnel
Dia Drill Holes
JOSEPHINE
LOT 4989
MYRTLE No 1
LOT 3396
PEARL M.C.
LOT 4990
LONDON No 4
LOT 3393
THE MACGILL No 2
LOT 4983
(or Greer)
VENICE Fr
LOT 5041
CALEDONIA No 3
LOT 2785
THAMES
LOT 5045
PRINCESS No 2
LOT 3394
MYRTLE No 2
LOT 3397
GOLDEN ZONE
L 4982
(or Greer)
CALEDONIA No 5
LOT 5030
NAPIER
L 4984
KING M.C.
LOT 5051
POMEF Fr
LOT 5061
WILLARD Fr
LOT 2788
GOLDEN ZONE
LOT 5055
CALEDONIA No 2
LOT 2784
Schist Belt
(Approx)
RUBY
LOT 5050
RIVER
Open Cut
(Iron & some copper)
QUEEN
LOT 5052
T.L. 2088
(Similkameen Placer Claim)
MAJESTIC
T.L. 2146
(Henry S. Cane)
SAN FRANCISCO
LOT 4985
PEACOCK
LOT 2785
(L. Davis)
CALEDONIA No 1
LOT 2784
ATLIN Fr
LOT 5039
Cabin
JAY BIRD Fr
LOT 2786
(L. Davis)
Cabin to mouth of Creek
11 miles
To Princeton 4 miles
BLUE
LOT 5057
North
SKETCH MAP SHOWING
MINERAL CLAIMS ON
INDIAN RIVER,
THE PROPERTY OF
BRITANNIA MINING & SMELTING Co
Scale 0 500 1000 1500 2000 3000 4000 Feet.
B.C. Bureau of Mines

mineralization is principally chalcopyrite, associated with which is chalcocite and bornite. The gangue is chiefly quartz. The vein which carries the ore is quite persistent, although it is narrow, but the grade of the ore averages so well that it is possible that a comparatively small mine having commercial value might be developed.

Samples and Assays.—A sample of float from a rock-slide below the mine-workings assayed: Gold, trace; silver, 1.8 oz.; copper, 19 per cent. Another sample, a grab from a small dump at the portal of the drift-adit, assayed: Gold, trace; silver, 1.8 oz.; copper, 15.5 per cent.

Development-work.—The development-work has all been done on the *Wanderer* claim and consists of a drift-adit about 155 feet long, with two short crosscuts and a raise from the adit.

Dawn Group.

This group consists of the *Dawn* and *Rose* mineral claims, owned by Warren Teeter and Fred Bucher; address, Heriot Bay. The group is about a mile south-westerly from the Heriot Bay Hotel, near the shore, a short distance from the entrance of Hyacinth bay. The claims are reached by a wagon-road from the Heriot Bay Hotel. This road is the main highway across Quadra island, connecting Heriot bay on the easterly side with Gowlland harbour and Quathiaski cove on the westerly side.

Geology.—The country-rock in the vicinity of the *Dawn* group is volcanic, typical of the southerly section of the island between the easterly and westerly coasts. The volcanic rock is very much sheared and fissured and presents favourable conditions for the occurrence of ore-deposits. The "Open Bay" limestone-belt contacts with the volcanics on this side of Quadra island at no great distance from the *Dawn* group, but it is doubtful if contact metamorphism has extended to the rocks on that group.

Ore-deposits.—The ore-deposit on the *Dawn* group occurs as a gash-vein filled with quartz mineralized with chalcopyrite, iron pyrite, and a little galena. The quartz vein where exposed by development-work is about 3 feet wide, with considerable gouge on the foot-wall side. The vein strikes north (mag.) and dips 85° to the east (mag.).

Samples and Assays.—Three samples were taken, two of which were said to have come from near the bottom of a shaft, full of water at the time of the examination, and the third was from sorted ore on a small dump at the collar of the same shaft. Sample No. 1 assayed: Gold, trace; silver, 0.8 oz.; copper, 4.4 per cent. Sample No. 2 assayed: Gold, trace; silver, trace; copper, 0.2 per cent. Sample No. 3 (dump) assayed: Gold, trace; silver, 0.8 oz.; copper, 10.9 per cent.

Development-work.—There are two shafts on the *Dawn* mineral claim, each said to be about 18 feet deep, but being full of water at the time of the examination could not be examined. There is also a long open-cut approach to the collar of one of the shafts.

VANCOUVER MINING DIVISION.

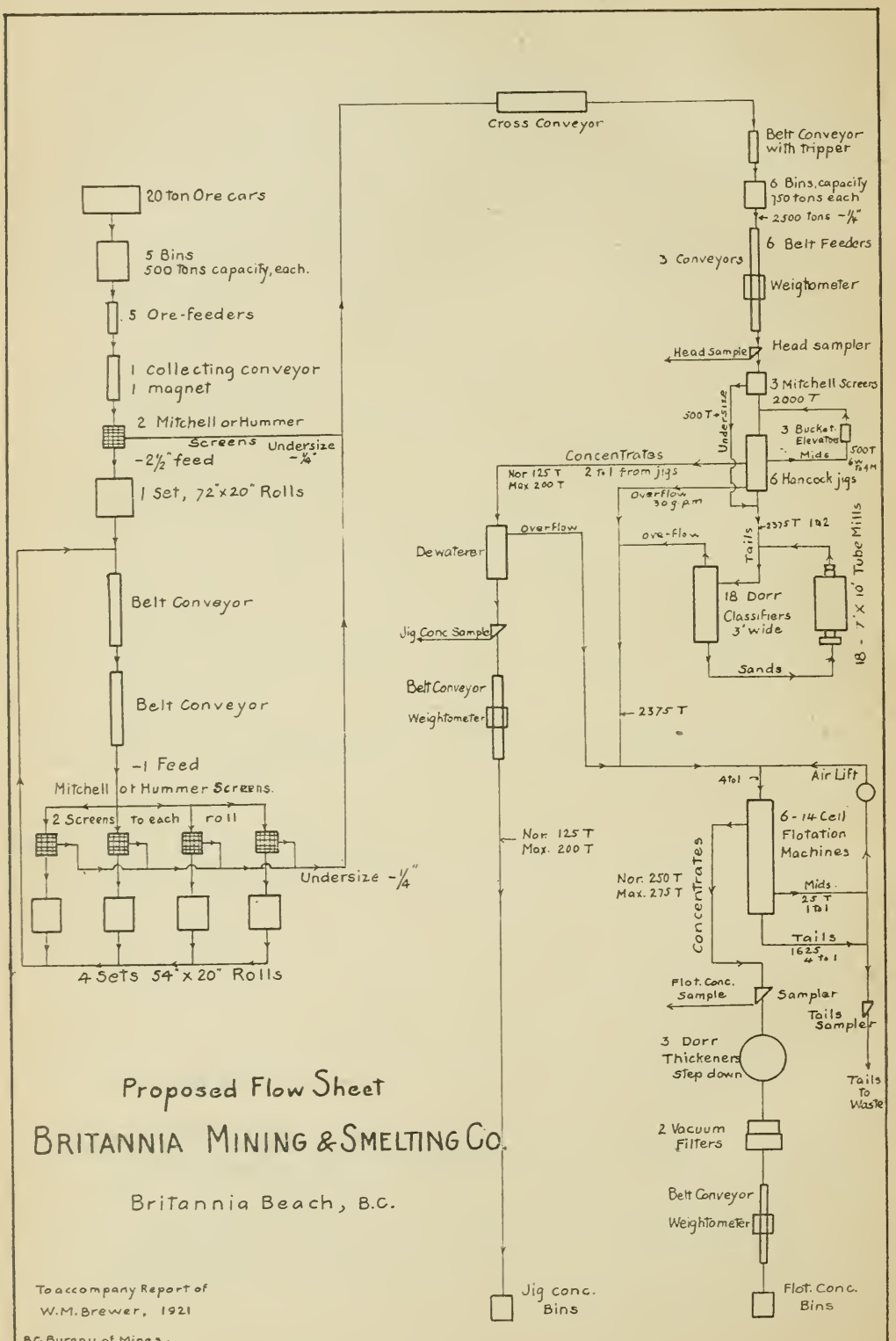
In the Vancouver Mining Division the development-work done during 1921 has been confined almost exclusively to that done by the Britannia Mining and Smelting Company on the *Britannia* mine, also by D. McKinnon, D. McCallum, and O. W. Rafuse on Ray creek, a tributary of the Stawamus river, and by J. Habrich on the Indian river.

The Britannia Company has kept about 250 men employed in extending the development-work in the mine and blocking out available ore. This work has resulted in largely increasing the tonnage of ore in sight, as well as exposing bodies of ore carrying very much higher values in copper than the usual run of mine ore heretofore worked.

The development-work done on Ray creek during the past year has resulted in determining the occurrence of what may be termed as the pay-shoot in the wide zone of schist. Samples taken at the time an examination was made by the writer early in September assayed from 0.1 to 6.8 per cent. in copper.

Britannia Mining and Smelting Co.

Early in February, 1922, the announcement was made that E. J. Donohue, who succeeded J. H. Moodie as general manager, had resigned that position, and that C. P. Browning, who has been superintendent of the mines of the company for several years, had been appointed general manager. While congratulating Mr. Browning on his well-deserved promotion and wishing him every success in the future, the writer desires to express his hearty appreciation of the many kindnesses and courtesies extended to him, both in his official position and personally, by Mr. Donohue, also to extend to him the sincere wish that he may enjoy health, happiness, and prosperity for many years to come.


Cross Conveyor
Belt Conveyor with Tripper
6 Bins, capacity 750 tons each
2500 tons -1/4"
6 Belt Feeders
3 Conveyors
Weightometer
Head Sample
Head sampler
3 Mitchell Screens 2000 T
500 T +1/4"
Undersize
3 Bucket Elevators
Mids
500 T
6 Hancock jigs
Concentrates
Nor 125 T Max 200 T
2 to 1 from jigs
Overflow 30 g.p.m.
2375 T 1&2
Tails
Over-flow
Overflow
Dewaterer
18 Dorr Classifiers 3' wide
18 - 7' x 10' Tube Mills
Sands
Jig Conc Sample
Belt Conveyor
Weightometer
2375 T
4 to 1
Air Lift
Nor 125 T Max 200 T
6 - 14 Cell Flotation Machines
Nor 250 T Max 275 T
Concentrates
Mids
25 T 1 to 1
Tails
1625 4 to 1
Flot. Conc. Sample
Sampler
Tails Sampler
3 Dorr Thickeners Step down
Tails To Waste
2 Vacuum Filters
Belt Conveyor
Weightometer
Flot. Conc. Bins
Jig conc. Bins
20 ton Ore cars
5 Bins 500 Tons capacity, each.
5 Ore-feeders
1 collecting conveyor
1 magnet
2 Mitchell or Hummer Screens
-2½" feed
Undersize -1/4"
1 Set, 72" x 20" Rolls
Belt Conveyor
Belt Conveyor
-1 Feed
Mitchell or Hummer Screens.
2 Screens to each roll
Undersize -1/4"
4 Sets 54" x 20" Rolls
Proposed Flow Sheet
BRITANNIA MINING & SMELTING CO.
Britannia Beach, B.C.
To accompany Report of W.M. Brewer, 1921
B.C. Bureau of Mines.

Since the concentrating-mill at Britannia Beach was destroyed by fire in 1921 the management has been busily engaged in making arrangements for rebuilding. Fred Bradley, of the firm of Bradley, Bruff & Labarthe, of San Francisco, was consulted with regard to a design for a new mill to replace the one destroyed by fire, with the result that contracts have been entered into with the Canadian Northwest Steel Company for building and equipping a plant having a capacity to treat 2,500 tons of ore daily, the flow-sheet of which is reproduced in this report. The building will be constructed of steel and concrete throughout and thereby be absolutely fire-proof.

Flow-sheet.—The upper floor of the new mill will be at a slightly lower elevation than the portal of the main haulage-adit, or about 250 feet above sea-level, known in the mine as the 4,100-foot level, it being about that distance vertically below the outcroppings on the *Fairview* mineral claim, from which the levels in the mine are numbered, the outcrop being zero. This main haulage-adit is about 4,900 feet long, 13 feet wide by 9 feet high, and is connected with the mine-workings on the 2,700-foot level by an incline rock-raise on a 65° slope, 1,488 feet high. This raise was finished in November last, so that when the new mill is completed everything is in readiness for haulage operations by this route, which will supplant the present incline tramway from the 2,700-foot level to the ore-bunkers at Britannia Beach.

The new mill is designed so that the ore from the mine, broken on the crusher level in the mine to a 2½-inch ring size, will be hauled in cars of 20 tons capacity through the main haulage-adit and delivered into ore-bins on the top story of the mill, where five bins, each having a capacity of 500 tons, will receive the broken ore. From these bins the ore passes through feeders to a collecting-conveyor equipped with a magnet and on to two Hummer screens, from which the undersize, ¼ inch or less, is carried to the lower story of the mill, and by a cross-conveyor to a belt-conveyor equipped with a tripper into five ore-bins, each having a capacity of 750 tons. From these bins the ore is carried by belt-conveyors to a weightometer, and from it into an automatic sampler. From the sampler the ore passes on to three Hummer screens, from which the undersize passes into Dorr classifiers, of which there are eighteen. The oversize from the Hummer screens passes into six Hancock jigs, from which the concentrates are discharged into a dewaterer, from there to an automatic sampler, which discharges the discard on to a belt-conveyor connecting with a weightometer, from which the concentrates are carried to the jig concentrates-bin in the mill building ready for shipment.

Of the undersized from the first set of Hummer screens which passes into the Dorr classifiers, the sands are discharged into eighteen tube-mills, each 7 by 10 feet, and from these mills are returned to the Dorr classifiers, the overflow from which, together with the overflow from the dewaterer following the jigs, as well as from the jigs, is conveyed to the flotation-cells. From these cells three products are made—concentrates, middlings, and tailings. The concentrates are conveyed to an automatic sampler, from that into three Dorr thickeners; thence into two vacuum-filters, which discharge on to a belt-conveyor connecting with a weightometer and conveyed to the flotation concentrates-bin in the mill ready for shipment; the middlings discharged from flotation-cells are conveyed to an air-lift and returned to the cells for further treatment; the tailings from the cells are conveyed to an automatic sampler, sampled, and discharged to waste-dump.

Returning to the top story of the mill to the Hummer screens, from which the undersize product has just been followed through the course of treatment to the shipping-bins, in order to describe the treatment accorded to the oversize feed discharged from the Hummer screens, it is found that it passes into a set of 72-inch by 20-inch rolls; then on to belt-conveyors, by which it is conveyed to Hummer screens, from which the undersize is conveyed to the lower story of the mill, where it is treated in the same manner as the undersize from the first-mentioned Hummer screens. The oversize from the second set of Hummer screens is conveyed to four sets of 54- by 20-inch rolls, from which the product is carried back to the belt-conveyors which follow the set of 72- by 20-inch rolls.

The bunkers on the shipping-wharf that have been used in the past from which to load concentrates into vessels are to be abandoned, and in their place the jig and flotation concentrates-bins in the mill will be used for storage-bins, which will be connected with the hold of a vessel at the wharf by a belt-conveyor about 2,000 feet long. This arrangement removes all danger from fire to the wharf bunkers, which has always been a source of anxiety in the past to the management.

At the Britannia Beach camp arrangements are being made to rebuild the residences and other buildings destroyed by the flood on a new site where the ground-level is so much higher than the old site that there will be absolutely no danger from a recurrence of any flood from such high water as occurred in October last. The culvert and fill on the electric railway across Britannia creek is being replaced by a steel suspension bridge, and no effort or expense is being spared by the company to avert danger in every way possible to conform with the "safety-first" policy.

In this respect the management has gone so far as to abandon nearly twenty buildings, including some large bunk and cook houses, at the 2,200-foot level camp, which was built to take the place of the old original camp on the 1,000-foot level, because there was a possibility that under aggravated conditions a rock-slide might occur which would endanger some of the buildings and mean disaster to the occupants.

During 1921 the operations at the mine have been confined almost entirely to development-work and the installation of improved ore-crushing machinery on the 1,700-foot level of greater capacity than has been employed in the past. In order to facilitate this installation a drift has been driven on a 30° slope 186 feet long from the 1,800-foot level to the 1,700-foot level, about 100 feet higher than the 1,800-foot level. The levels in the Britannia are numbered from the surface outcrop, 4,350 feet above sea-level, downward to the 4,100-foot level, which is about the same level as the roof of the mill building at Britannia Beach, about 2 miles in an air-line westerly from the open-cut on the *Fairview* mine.

Heretofore the ore-crushers have been operated on the 1,800-foot level, but in future there will be on the 1,700-foot level the 24 by 36 jaw-crusher formerly on the 1,800-foot level, also a 7½ K. gyratory crusher, while on the 1,800-foot level a new gyratory crusher of the same type and size will occupy the former position of the jaw-crusher. This arrangement, which necessitated the excavation of a large crusher-chamber on the 1,700-foot level, will afford a 2-stage preliminary crushing of the ore to 2½-inch ring previous to its transportation from the mine to the mill.

Another improvement in connection with the gravity system of handling ore through rock-raises has been the erection of a heavy reinforced concrete bulk-head in the main 68 ore-raise. This bulk-head directs the ore to the crushers, which discharge the crushed product into the ore-raise below the bulk-head.

The development-work done during 1921 was principally on the *Victoria* section of the property, easterly from the *Fairview* and *Empress* sections, where a newly discovered ore-body was developed. With regard to this ore-body, it is interesting to note that its discovery was one of the results of the geological examination made by Dr. S. J. Schofield, of the Geological Survey of Canada, during the seasons of 1919 and 1920. In accordance with his advice, Mr. Moodie, the then general manager, undertook prospecting with diamond-drills in ground that had previously been considered as practically barren. The result was that an apparently extensive body of copper-sulphide ore was proved. Samples from this, when assayed, showed higher average values than had before been found in the sections of the Britannia mine that had been worked since operations began. The ore-body occurs on and below a level corresponding with the 1,900-foot level in the main workings, and considerably lower than the ore-bodies in those workings have yet been developed.

In detail the development-work done in the mine during 1921, nearly all of which was on the *Victoria* section, has been as follows: Drifts, 1,909 feet; crosscuts, 1,027 feet; raises, 3,194 feet; winzes, 118 feet; giving a total of 6,248 feet. No diamond-drilling has been done on the property during the past year.

A winze is being sunk from the 1,900-foot level on the *Victoria* section, through which ore from the levels below will be hoisted and delivered into buckets on an aerial tram, by which it will be transported to the portal of the adit on the 1,600-foot level in the *Empress* section, and from there transported to the top of the ore or rock raise on the 2,700-foot level, down which it will fall into bunkers in the main haulage-adit on the 4,100-foot level.

A sawmill with capacity of 30,000 feet B.M. daily has been built near the entrance to the *Victoria* section for cutting and shaping mine-timbers. A 3-story bunk-house, 30 by 100 feet, has been built and a dry-house, 25 by 40 feet, for the accommodation of the miners working in that section.

Shipments.—The only shipments made during 1921 were from the bunkers at Britannia Beach, the product on hand at the close of 1920. These shipments were made to the Tacoma

smelter, as follows: Tons of ore and concentrates shipped, 47,385 tons; product, 646 oz. gold, 7,943 oz. silver, and 1,411,376 lb. copper.

Stawamus River Section.

Bruce and Radiant Groups.

The following report describes the geography, geology, ore-deposits, development-work, samples and assay values of the sulphide ores which occur in a wide zone of siliceous schists crosscut by Ray and Little Ray creeks, tributaries of the Stawamus river. This zone of schists is evidently a remnant of one of the undestroyed roof-pendants that occur in the granodiorite intrusive batholith of the Coast range. It has been suggested that the zone is an extension of the Britannia belt, but apparently such a theory is not warranted, because a wide belt or zone of granodiorite occurs between the schists of the Britannia belt and those on Ray creek. It appears more probable that the Ray creek schist country-rock is an example of an isolated lens of considerable extent of a remnant of one of the undestroyed roof-pendants.

The schists are heavily mineralized with iron pyrites and some chalcopyrite, with the iron pyrites very much in excess of the chalcopyrite at the lower elevation; in fact, the pay-shoot appears to occur only at an elevation higher than about 2,000 feet and near the contact between the schists and granodiorite. The encouraging feature regarding the groups of mineral claims considered in the following report is the fact that the observations of Camsell and other geologists and engineers as to the occurrence of remnants of undestroyed lenses of roof-pendants made up of more or less metamorphosed sedimentary rocks in the Coast Range batholith are not only proving correct, but the occurrences are much more numerous and extensive than the reports of those authorities indicated some years ago.

Prospectors should be interested in these facts, but bear in mind that in order to find ore of a commercial value it is necessary to climb to the higher elevations and search for contacts between the granodiorite and altered sedimentary rocks. It also appears that the higher values are associated with quartz gangue, for while the iron pyrites occurs in great abundance in the schists, the material carries very little chalcopyrite, except when the gangue is almost entirely of massive quartz, in which the structure has a tendency towards the ribbon or banded variety.

Area and Title.—The *Radiant* group contains six mineral claims, or about 300 acres; the *Contact* group contains four claims, or about 200 acres; and the *Bruce* group also contains four claims, or about 200 acres. The *Radiant* and *Contact* groups of mineral claims are owned by O. W. Rafuse and associates, of Vancouver. The *Bruce* group is owned by D. McCallum, of Squamish; Dan McKinnon and A. H. McKinnon, of Vancouver.

Geography.—The *Radiant* group of mineral claims is in the mountains paralleling the Stawamus river on the northerly side of the river; the *Bruce* group adjoins the *Radiant* group on the north-easterly side and its southerly boundary is on the south side of Ray creek, a torrential stream emptying into the Stawamus river about 5 miles in an easterly direction from the mouth of that river on the east side of the head of Howe sound near Squamish, the western terminal of the Pacific Great Eastern Railway; the *Contact* group adjoins the *Bruce* group on the easterly side and extends in an easterly direction towards the head of Ray creek and the summit of the mountain range in which that creek has its source.

The *Radiant*, *Bruce*, and *Contact* groups of mineral claims are reached by pack-horse trails from Squamish, about 2½ miles, to near the dam of the Squamish water-power and electric-light plant on the Stawamus river, where a foot-trail branches towards the south-east into the mountains for a distance of about 3 miles to beyond the cabin on the *Radiant* group, and to a point on Little Ray creek where work is done on the *Bruce No. 2* mineral claim.

Little Ray creek is a mountain stream with a precipitous fall from its source near the summit of the range of mountains, from which it flows in a westerly direction across the *Bruce No. 2* and *No. 3* claims, joining the main Ray creek near the westerly boundary of the *Bruce No. 3* mineral claim.

The mountain range to the easterly from the groups of mineral claims rises to an elevation of about 5,000 feet above sea-level, with some peaks reaching an altitude of over 6,000 feet. The altitude of the prospecting-work done on the *Bruce* and *Contact* groups is about 3,000 feet above sea-level.

Geology.—There is an exceptionally good opportunity afforded on the *Radiant*, *Bruce*, and *Contact* groups of mineral claims to study the geology of that section, for the reason that Ray

creek practically crosscuts the rock formation for a distance of about a mile. The creek flows generally from east to west, while the strike of the bands of argillites, quartzites, and talc-schists exposed in both of the steep banks of the creek is north-westerly and dip varying from about 65° towards south-west to vertical.

The granodiorite of the Coast Range batholith is exposed in the narrow valley of the Stawamus river, and the country-rock for about half a mile up Ray creek from its junction with the Stawamus is made up of similar rock, but at this point there is a well-defined contact between the granodiorite and a band of sedimentaries in which argillite, quartzite, and a talcose schist predominate. As the bed of the creek is followed up towards its head in high mountains to the east, the band of sedimentaries is crosscut to a point where another contact occurs near the head of Ray creek between the sedimentaries and granodiorite.

It is noticeable that at the lower elevation the schist is extremely talcose, but as higher elevations are reached there occur more quartz and quartzite in the country-rock, and the schist becomes more siliceous and quartz kidneys often occur as inclusions in the schist. It is in the latter class of country-rock that mineralization is the most pronounced.

Ore-deposits.—Mineralization occurs generally in the bands of schist. This mineralization at the lower elevations consists entirely of iron pyrite usually disseminated through the schist gangue in small particles, but sometimes occurring massive in lumps of considerable size of practically solid iron sulphide. Several samples assayed at various times of this variety of the mineralization have failed to show any values except iron and sulphur.

Owing to the great width of mineralized schist crosscut by Ray creek, intensive surface prospecting has been carried on for the past three years, and it has been proven that at higher elevations near the head of Ray creek, approaching the contact on the north-easterly side of the sedimentary belt, the mineralization includes chalcopyrite associated with iron pyrites, some samples of which carry satisfactory values in copper.

The extent of the deposits of ore carrying copper values is as yet undetermined; apparently there are several belts of schist which carry the mineral and occur within a width of about 600 feet. In each of these various belts there appears to be a concentration of the mineralization varying in width. Most of the mineralized belts can be superficially examined from the creek-bed, but as the banks for the most part are so precipitous as to form a canyon which can only be travelled during extreme low water, it is impossible to satisfactorily determine the extent of the ore-bodies except by actual work of drifting and crosscutting.

The occurrence of the mineralization in which chalcopyrite in appreciable quantity occurs associated with iron pyrites are found on the *Bruce No. 2* and *Bruce No. 1* claims of the *Bruce* group, also on the *Dorothy* claim of the *Contact* group.

Samples and Assays.—Six samples were taken from the *Dorothy* claim, one from the *Bruce No. 1*, and one from the *Bruce No. 2* claims, which assayed as follows:—No. 1, *Dorothy* claim: Gold, *nil;* silver, *nil;* copper, 0.1 per cent. No. 2, *Dorothy* claim: Gold, trace; silver, trace; copper, 0.5 per cent. No. 3, *Dorothy* claim: Gold, trace; silver, trace; copper, 5.6 per cent. No. 4, *Dorothy* claim: Gold, trace; silver, 1.6 oz.; copper, 6.8 per cent. No. 5, *Dorothy* claim: Gold, trace; silver, 0.8 oz.; copper, 3.5 per cent. No. 6, *Dorothy* claim: Gold, trace; silver, trace; copper, 2 per cent. No. 7, *Bruce No. 1* claim: Gold, trace; silver, trace; copper, 0.4 per cent. No. 8, *Bruce No. 2* claim: Gold, trace; silver, trace; copper, 1 per cent.

Development-work.—The development-work on the *Radiant* group consists of a series of open-cuts for prospecting; these open-cuts vary in size; one of the largest is 26 feet long, 5 feet wide, and from 6 to 12 feet deep.

The development-work on the *Bruce* group consists of two adits and several open-cuts in the banks of Ray and Little Ray creeks. One adit on the *Bruce No. 3* claim is 36 feet long as a drift, from which there is a crosscut 12 feet long; the other adit on the *Bruce No. 2* claim is 25 feet long as a drift.

The development-work on the *Contact* group is confined to several open-cuts on the *Dorothy* claim. These cuts have been made into the steep banks of Ray creeks on both sides of the creek, in an effort to determine the location of the pay-shoots, also to gain some idea of the extent of the mineralization.

NEW WESTMINSTER MINING DIVISION.

The mining industry in the New Westminster Mining Division during 1921 has not shown the activity which was anticipated at the beginning of the year, when it was expected that the

Guggenheim interests would complete negotiations for the *Lucky Four* group of mineral claims in the Cheam range of mountains, which forms the watershed between the Fraser and Chilliwack rivers. The negotiations were cancelled, and consequently the development-work on that group has not been carried on to any great extent during 1921.

Some prospecting was done in the Fire Mountain section, near the head of Harrison lake, on some of the gold-bearing quartz veins in the vicinity of the old *Money Spinner* mineral claim, which was prominent in 1897 and 1898. It is the intention of the syndicate, the writer is informed, to continue the work during 1922.

Indian River Section.

Indian River section of the New Westminster Mining Division was first prospected about 1910, when S. A. Habrich and partner were engaged in prospecting on the headwaters and located the *Belle* group of mineral claims. It was not until 1912 or 1913 that the section was given much more attention. Then several other prospectors staked mineral claims in the mountains paralleling both sides of the river wherever outcroppings indicated the occurrence of deposits of copper-sulphide ores.

Habrich figured that the *Belle* group of mineral claims was located on an extension of the Britannia mineralized zone and in the same geologic formation, but later prospecting showed indications that the Britannia belt was separated from the mineralized zone in which the *Belle* group is situated by a belt of granodiorite on the west of the last-named group.

The rocks occurring on the *Belle* group, as classified by Chas. Camsell.* "consist of argillite, greenstone, and limestone that is metamorphosed by the development in it of much quartz and biotite."

Prospecting later than 1913 showed that apparently an extension of the Britannia mineralized zone did occur in the mountains adjacent to Indian river a few miles south-easterly from the *Belle* group, and investigations made by mining engineers in the employ of the Britannia Mining and Smelting Company resulted in the purchase by that company of the several groups of mineral claims on Indian river shown in the accompanying sketch-map.

Similar geologic formations to those occurring in the Britannia mineralized zone occur in a zone on the several groups shown on the map, but there is a presumably wide belt of granodiorite separating the known eastern boundary of the Britannia belt from the Indian River mineralized zone, although but little is really known of that mountainous section in the vicinity of Loch Lomond and the headwaters of the West and East forks of Seymour creek.

Geography.—Indian river has its source in the mountains about 12 miles south-easterly from Squamish, the ocean terminus of the Pacific Great Eastern Railway at the head of Howe sound, and about 4 miles north-easterly from Loch Lomond. The course of the river is south-easterly to its mouth at the head of the North arm of Burrard inlet. Its total length is about 20 miles. The river occupies a heavily wooded valley in the Coast range of mountains, the peaks of which rise to elevations of from 3,000 to 4,000 feet above sea-level on either side.

The groups of mineral claims on Indian river are reached either from Squamish by way of the Squamish–Stawamus pack-horse trail to the divide and down Indian river, or by launch from Vancouver to the head of the North arm of Burrard inlet to the terminus of an old wagon-road 6 miles long; then pack-horse trail up the river to the cabin on the *Caledonian No. 1* mineral claim, distant 11 miles from the mouth of the river. On this mineral claim occurs the south-eastern boundary, so far as known at present, of the mineralized zone.

Geology.—The geology of the Indian River section is described by Chas. Camsell* when he made a trip from Squamish to the mouth of Indian river and examined the *Belle*, *Bulliondale*, *London*, and *Roy* groups of mineral claims. Later in 1917 the same trip and examinations were made by the writer of this report, whose report was published in the Annual Report of the Minister of Mines for that year, pages 275–278.

Development-work.—Since 1917 the Britannia Mining and Smelting Company has acquired by purchase and Crown-granted all of the groups of mineral claims referred to, except the *Belle*, *Bulliondale*, and *London* groups. The company has since then carried out considerable systematic development-work on several of the claims in order to determine important data relative to the extent of the mineralized zone and the values carried by the deposits of copper-sulphide ores that occur in the zone.

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* Camsell, C., Geol. Surv., Can., Sum. Rept., 1917, pages 23B to 25B.

VICTORIA MINING DIVISION.

About the only work of any importance that was performed in the Victoria Mining Division during 1921 was that done on the *Gabbro* group of mineral claims on Jordan river, about 40 miles from Victoria, and the work done by W. G. Dickenson on the deposits of talc on Wolf creek, a tributary of the Sooke river.

Gabbro Group.

This group contains twenty-three mineral claims and adjoins the *Sunloch* group. The *Gabbro* group extends on both sides of the Jordan river and is located down the river from the *Sunloch* group. During 1921 prospecting-work done on the *Vulcan No. 2* and *No. 3* mineral claims of the group exposed a body of pyrrhotite ore in what is known as the Stewart ore-zone, one sample from which assayed: Copper, 2.3 per cent.; nickel, 0.58 per cent.; and another, nickel 0.45 per cent. This body of ore has a maximum width of 30 feet and minimum of 12 feet, as exposed by four open-cuts in the mountain-side about 250 feet above the Sunloch Company's tramway. Nickeliferous ore is also found in pyrrhotite on the Winkler ore-zone in the south-east corner of the *Vulcan No. 2* mineral claim. These ore-zones occur in the gabbro country-rock near the contact between it and the Metchosin volcanics, in which the ore-bodies on the adjoining *Sunloch* group occur.

On the *Vulcan No. 6* claim of the *Gabbro* group a body of copper-sulphide ore of commercial grade is exposed in an open crosscut 25 feet long, 8 to 10 feet deep by 4 feet wide. The ore-body as shown in the cut is 6 feet wide.

On the *Vulcan No. 5* claim of the *Gabbro* group a body of copper-sulphide ore averaging about 3 per cent. in copper is exposed by open-cuts. This body of ore is apparently an extension of the Cave ore-zone, which occurs on the adjoining *Sunloch* group. The ore-body has been opened up on the river-level, where the ore is about 10 feet wide; it has also been opened up on the mountain-side about 200 feet above the river, where the ore is about 9 feet wide.

Several open-cuts have been made on the *Hornet Fraction* and *Cliff Fraction* claims of the *Gabbro* group, as well as on the Turnbull ore-zone, which occurs in basalt country-rock south-westerly from the Cave ore-zone on the *Sunloch* group.

During 1921 a commodious log cabin was built on the *Vulcan No. 6* claim of the *Gabbro* group. This is on the mountain-side about 500 or 600 feet higher than the bridge across the Jordan river on the *Sunloch* group of mineral claims.

OCHRE-DEPOSIT ON DEMANIEL CREEK.

On October 9th and 10th, 1921, the writer examined a deposit of yellow ochreous clay or impure bog-iron ore on Demaniel and Stony creeks, in the Otter district of the Victoria Mining Division, near the Sooke Post-office, about 3 miles westerly from the track of the Canadian National Railway and 26 miles from Victoria by auto-road.

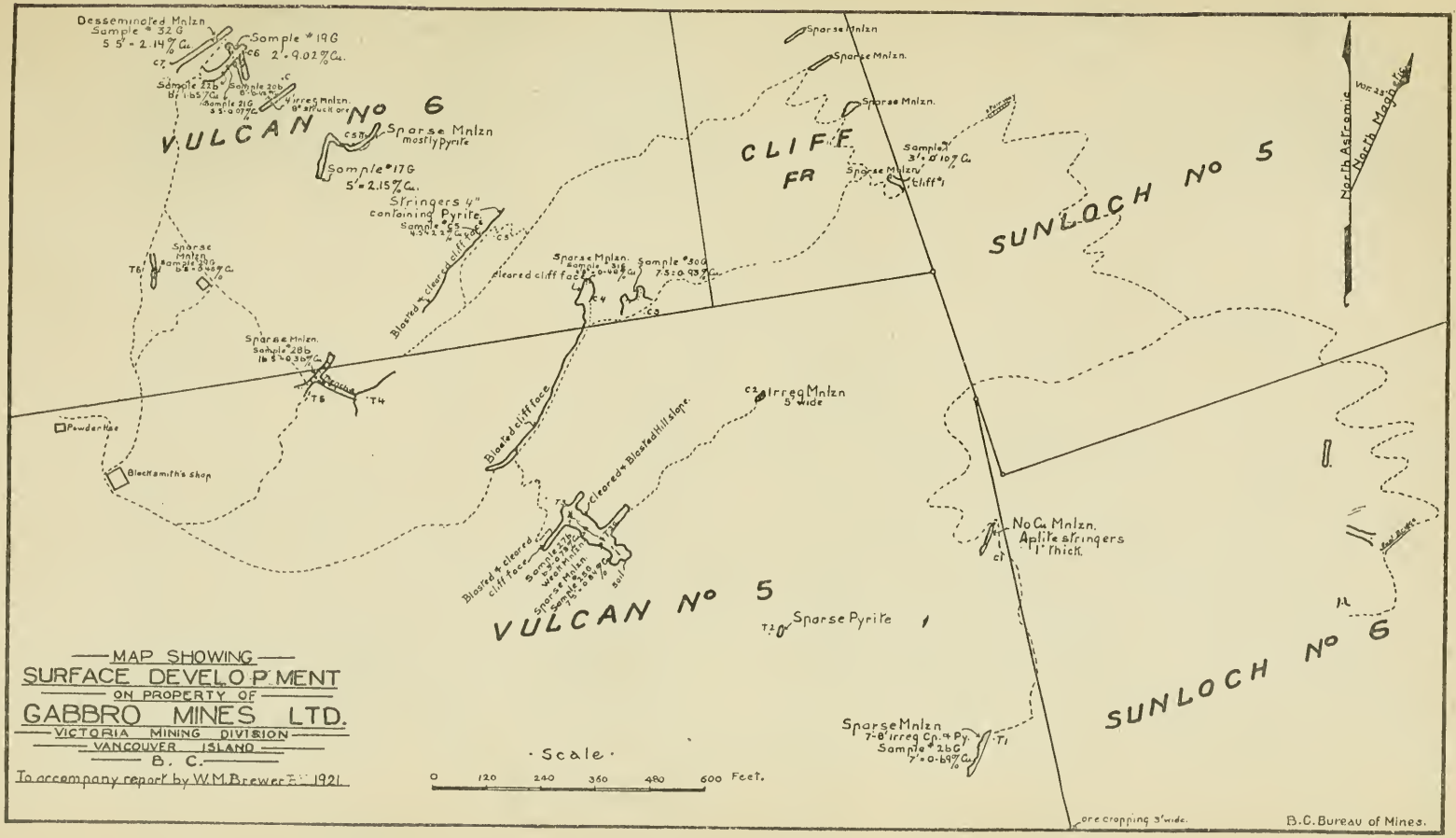
The property is made up of the *Florence* mineral claim, owned by Dan. Campbell, of Victoria, and staked on Demaniel creek at a point about half a mile southerly from Young lake, and where the creek flows from south-west (mag.) to north-east and within a few yards of the Victoria–Jordan River auto-road, also a land lot traversed by Stony creek, which flows into Demaniel creek about three-quarters of a mile north-east from the deposit on Demaniel.

The deposit was examined by Chas. H. Clapp about 1910 and is reported on in Memoir No. 13, "Southern Vancouver Island," Canada Geological Survey, 1912, page 198, under the heading "Pigments."

In his report Clapp says: "The deposit consists of a very fine-grained clay, with which is mixed fairly uniformly bog-iron ore or limonite. Limonite also occurs in small concretions. An analysis of a sample from the deposit showed the iron content to be 15.5 per cent. Near the surface the deposit contains angular fragments of the Metchosin volcanics, but these have doubtless been washed in by the Demaniel river during times of high water and they do not continue in depth. The material has been deposited during late Pleistocene or recent times in a bog which probably represented the end stage in the filling-up of one of the transient lakes which collected in the hollows of the drift-mantel at the close of the period of glacial occupation. The material could readily be washed and purified, and the product, although valueless as an iron ore on account of its low iron content, would make a good base for coloured paints."

DEMANIEL CREEK DEPOSIT.

The examination made by the writer was mainly with a view of determining as far as possible from a superficial examination the probable or possible extent of the deposit or deposits.


Disseminated Mnlzn
Sample # 32 G
5' - 2.14% Cu.
Sample # 19 G
6' - 9.02% Cu.
Sample # 21 b
Sample # 20 b
Irreg Mnlzn
VULCAN No 6
Sparse Mnlzn
mostly Pyrite
Sample # 17 G
5' - 2.15% Cu.
Stringers 4"
containing Pyrite
Sample # 33
Sparse Mnlzn
Sample # 28 G
Sparse Mnlzn.
Sample # 28 b
Powder Hse
Blacksmith's shop
Blasted & cleared cliff face
Cleared cliff face
Sparse Mnlzn.
Sample # 30 G
Sparse Mnlzn.
Sparse Mnlzn.
Sparse Mnlzn.
CLIFF
FR
Sample #
Sparse Mnlzn
Cliff # 1
SUNLOCH No 5
North Asturmic
North Magnetic
Irreg Mnlzn
5' wide
Blasted cliff face
Cleared & Blasted Hill slope
Sparse Mnlzn
Sample # 31 G
Sparse Mnlzn
Sample # 30 G
VULCAN No 5
Sparse Pyrite
No Cu Mnlzn.
Aplite stringers
1" thick.
Sparse Mnlzn
7-8' irreg Cu & Py.
Sample # 26 G
SUNLOCH No 6
MAP SHOWING
SURFACE DEVELOPMENT
ON PROPERTY OF
GABBRO MINES LTD.
VICTORIA MINING DIVISION
VANCOUVER ISLAND
B. C.
To accompany report by W.M. Brewer, 1921
Scale
0 120 240 360 480 600 Feet.
ore cropping 3' wide.
B.C. Bureau of Mines.

GEOLOGIC AND TOPOGRAPHIC MAP
OF A PORTION OF THE
GABBRO AND SUNLOCH PROPERTIES
SURFACE
OVERLOCMENT
LEGEND
SECTION AA
V.I.P. Co
RESERVOIR
GABBRO
VULCAN N°6
VULCAN N°5
VULCAN N°4
VULCAN N°3
VULCAN N°2
VULCAN N°1
VULCAN FR
HORNET FR
YELLOW JACKET
BLACK HORNET
TIGER
CLIFF FR
Geol
Bas
Gab

As the development-work which had been done some time back in the bed of Demaniel creek has been obliterated, several holes were bored during the examination with an earth-boring auger into the outcroppings along the south-easterly bank of the creek, also the face of a bluff about 150 feet north-easterly from the discovery post was dug into to ascertain some data with regard to the continuity of the deposit in that direction. Samples of the ochreous clay were taken for the purpose of analysis.

In the bed of Demaniel creek and along the south-easterly bank the outcroppings of the deposit are continuous for about 300 feet in a south-westerly direction from the discovery post, and for an average width of about 40 feet, which width in places is apparently considerably greater, but the outcroppings are not exposed without a break; for example, in a pig-pen some 50 feet or so from the south-easterly bank of the creek and in the same direction the ochreous material outcrops, but is not exposed between the pig-pen and the discovery post, the surface there being covered by rocks and soil and no prospecting-work done.

About 100 feet north-easterly from the discovery post the course of the creek is deflected towards the east, the water flowing around a low bluff which is about 40 feet high. By digging into the almost vertical face of this bluff the ochreous material was exposed for a width of 40 feet, and was also exposed by a shallow hole dug on the flat at the top of the bluff about 20 feet back from its face, where the timber has been logged off.

From these data it is apparent that the strike of the deposit is north-easterly, with dip in a north-westerly (mag.) direction, but the exposures are not sufficiently opened up to determine the angle of the dip.

Holes bored into the outcroppings along the south-easterly bank of the creek during the examination showed that the thickness of the ochreous material exceeded 3 feet, with no change at that depth.

It is not possible in the present condition as to work to determine the tonnage in sight, but from the foregoing it will be seen that the probable or possible tonnage is quite considerable; ample, in fact, to warrant mining operations and guarantee a supply equal to any reasonable demand for some time to come.

Stony Creek Deposit.

On a small creek known as Stony creek, a tributary of Demaniel creek, into which it flows, about three-quarters of a mile in a north-easterly (mag.) direction from the outcroppings of the ochreous deposit exposed in that creek, similar outcroppings occur. These can be traced along the steep south-easterly bank of Stony creek for a considerable distance, striking in a north-easterly (mag.) direction, but no work has been done to determine any material facts as to extent in width or depth. Apparently the deposit on Stony creek may occur as paralleling that on Demaniel creek, or it may be found after systematic prospecting has been done that the first mentioned is an extension of last named. In any event it is evident that the Stony Creek occurrence will materially increase the quantity of ochreous material that can be easily mined and transported from the district.

The Stony Creek deposit occurs on Crown-granted land owned by Dan. Campbell, of Victoria, who also owns the deposit on Demaniel creek.

List of Samples, with Assay Results.

Nos. 1 and 2, from *Florence* mineral claim, taken from the south-eastern bank of Demaniel creek:—No. 1: Manganese, trace; iron oxide, 12.87 per cent.; silica, 35 per cent.; alumina, 32.73 per cent. No. 2: Manganese, trace; iron oxide, 17.2 per cent.; silica, 28.5 per cent.; alumina, 26.8 per cent.

No. 3, from *Florence* mineral claim, taken from the face of bluff outcrop, about 150 feet north-easterly (mag.) from the discovery post: Maganese, trace; iron oxide, 21.45 per cent.; silica, 26.5 per cent.; alumina, 38.55 per cent.

No. 4, from bank of Stony creek: Manganese, trace; iron oxide, 27.2 per cent.; silica, 28 per cent.; alumina, 31.2 per cent.

ALBERNI DISTRICT.

ALBERNI MINING DIVISION.

REPORT BY A. G. FREEZE, GOLD COMMISSIONER.

I have the honour to submit a brief annual report on mining in the Alberni Mining Division during the year ending December 31st, 1921.

Big I. Group.—This group of claims, situated 10 miles north-westerly from the head of Great Central lake, which was formerly held under bond by the Consolidated Mining and Smelting Company, Limited, of Trail, has reverted to the original owners, M. Tebo and J. A. Drinkwater. Nothing has been done on the group during the year except the annual assessment-work.

Monitor Group.—Nothing has been done on this group during the year.

W.W.W. Group.—This group, which has lain idle for a number of years, was purchased at tax sale last year by J. H. Davey, Jr., who has sold to a Mr. McLeod, who, I understand, intends to develop it during the coming year.

OFFICE STATISTICS—ALBERNI MINING DIVISION.

Mineral claims recorded	2
Certificates of work recorded	31
Free miners' certificates issued	40
Bills of sale recorded	3

Revenue.

Mining receipts, general	$150 25
Free miners' certificates	158 75
Total	$309 00

CLAYOQUOT MINING DIVISION.

REPORT OF WALTER DAWLEY, MINING RECORDER.

I have the honour to submit the annual report on mining operations in the Clayoquot Mining Division for the year ending December 31st, 1921.

Bear group of mineral claims, owned by Chas. Sundwell and situated on Elk river. Considerable work has been done on these claims this season.

The Woodworth property, owned by J. B. Woodworth and situated on Bear river. Work has been going on for several months installing a plant to treat on the property the ore which carries high values.

The Tidewater Copper Company, on Sidney inlet, is still closed down owing to the low price of copper.

Several placer leases have been staked at Wreck bay.

The annual assessment-work has been done on a number of claims, but there have been no shipments from any of the mines in the district.

OFFICE STATISTICS—CLAYOQUOT MINING DIVISION.

Mineral claims recorded	23
Certificates of work	14
Free miners' certificates issued	24
Transfers recorded	1
Powers of attorney recorded	4
Other receipts issued	3

Revenue.

Mining receipts	$105 75
Free miners' certificates	114 00
Total	$219 75

QUATSINO MINING DIVISION.

Report by Ed. Evenson, Mining Recorder.

I have the honour to submit the annual report on the mining operations in the Quatsino Mining Division for the year ending December 31st, 1921.

Except the regular assessment, no work has been done on mineral claims in Quatsino Mining Division this past year.

On the *Old Sport* group development-work has been confined to diamond-drilling 900 feet. It has been closed down since June, 1921.

On the *Millington* group, located at Spruce river, at the head of West arm, considerable prospecting-work has been done and the showing is very good; also a road has been built to the mine from the main road from Holberg.

On the *Seal* group, located 3 miles east of Holberg, on the south side of West arm, considerable prospecting-work was done this summer and the showing is very good.

Office Statistics—Quatsino Mining Division.

Mineral claims recorded	23
Certificates of work	75
Powers of attorney and transfers	7
Certificates of improvements	14
Mining receipts	35
Free miners' certificates	62
Special free miners' certificates	1
Total revenue	$900 50

NANAIMO DISTRICT.

NANAIMO MINING DIVISION.

REPORT BY S. McB. SMITH, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the mining operations in the Nanaimo Mining Division for the year ending December 31st, 1921.

During the year the mining industry in the Nanaimo Mining Division has not been as active as could be desired. There have been ten placer-mining leases granted to applicants in the north-western portion of Vancouver island in the vicinity of Cape Sutil, formerly known as Cape Commerell. There have also been several applications for placer-mining leases for areas situated in the vicinity of Cape Scott, north-western end of Vancouver island.

Active operations have been carried on at Lasqueti island by Henry Lee, managing director of the Lasqueti Mining Company.

Further prospecting operations have been carried on by the Paramount Mining Company on its groups of mineral claims on Myra and Price creeks, at the head of Buttle lake, Strathcona Park.

The Tatlayoko Lake Gold Mining Company has been engaged during the past year in sawing lumber and making preparations to erect a concentrating-mill on the company's property near the foot of Tatlayoko lake.

Wm. M. Brewer, Resident Engineer, has examined several properties during 1921, and I presume will give detailed descriptions in his annual report. Therefore it is only necessary for me to add the office statistics to this report, which are as follows:—

OFFICE STATISTICS—NANAIMO MINING DIVISION.

Mineral claims recorded	152
Certificates of work recorded	263
Bills of sale, etc., recorded	48
Free miners' certificates recorded	216

Revenue.

Free miners' certificates	$1,008 00
Mining receipts	2,490 20
Total	$3,498 20

VICTORIA DISTRICT.

VICTORIA MINING DIVISION.

Report by Herbert Stanton, Gold Commissioner.

The Resident Engineer, Wm. M. Brewer, having covered this Mining Division in his report, I beg to submit the office statistics for the year 1921.

Office Statistics—Victoria Mining Division.

Free miners' certificates issued	345
Free miners' certificates (special) issued	3
Mineral claims recorded	24
Placer claims recorded	1
Certificates of work recorded	47
Bills of sale recorded	36
Certificates of improvements issued	1

Revenue.

Free miners' certificates	$2,776 25
Mining receipts	554 43
Total	$3,330 68

VANCOUVER MINING DIVISION.

Report by A. P. Grant, Mining Recorder.

I have the honour to submit the following report of the mining operations in the Vancouver Mining Division for the year ending December 31st, 1921:—

The following is a list of the number of claims and the localities in which they are situated:—

Jervis inlet	2
Mill creek	3
Alta lake and Pacific Great Eastern Railway	19
Lynn creek	9
McCartney creek	2
Stawamus river	3
McNab creek	4
North arm	2
Salmon arm	7
Cypress creek	5
Total	56

The snow staying so late on the hills during the last year did not allow prospectors to get out as early as usual, so there were less claims recorded than for some years previously.

The development-work done on the *Attorney* group, situated on Howe sound, was simply the annual assessment-work. This work confirms the opinions of the owners that their properties are part of the *Britannia* formation. They are very heavily mineralized and all have copper.

C. M. Oliver, of the Bowena Mining Company, states that at the *Bowena* copper-mines, Bowen island, repairs to the compresser were made last May and a tramway for bringing in supplies of wood fuel built. A good supply of fuel was laid in and development-work continued up to the end of June. Since that time nothing further has been done, although the lessees of the property hope to resume operations, both mining and milling, as soon as the market price of copper has advanced to 15 cents a pound.

No work was done on the Snug Cove property during 1921, but the company expects to resume development-work early in 1922.

T. W. Lillie, part owner of the *Virgo* and *Jupiter* groups of twelve claims on the west bank of Britain river, Jervis inlet, states: "Work has been done on three different levels—namely, 2,000, 3,500, and 4,500 feet elevation. At the 2,000-foot level the lead is 50 feet in width, carrying gold, silver, lead, zinc, pyrrhotite, and copper. At the 3,500-foot level the lead is 200 feet in width, showing mineral in good quantities all the way across, consisting of copper, galena, gold, platinum, with less zinc. At the 4,500-foot level we have uncovered an 8-foot lead of a very fine grade of galena. The best assays we received were: Chalcopyrite, 17 per cent.; silver, $140; lead, $60; zinc, $40; gold, $18; platinum, $3. The copper also carries: Silver, 23 oz.; gold, $2.50; platinum, $3. We have a fairly good trail up to our claim, built by ourselves."

E. J. Donohue, general manager of the Britannia Mining and Smelting Company, Limited, states: "During the year 47,385 tons of ore was drawn from the mine. The development footages were as follows: Drifts, 1,909 feet; crosscuts, 1,027 feet; raises, 3,194 feet; winzes, 118 feet, which gives a total footage driven of 6,248. There was no diamond-drilling during the period.

"*Mining and Development Work.*—For the first three months of the year there were underground shrinkage stopes in operation, particularly on the 250-foot level. A drift 186 feet long was driven on a 30° slope from the 1,800- to the 1,700-foot level, at which point a crusher-chamber was enlarged for the installation of the 24 by 36 jaw-crusher previously operating on the 1,800-foot level, complementing a 7½ gyratory crusher. A new gyratory crusher, the same type and size as the one in place, is to be set up in the former position of the jaw-crusher. With the above installation it is arranged to give a 2-stage preliminary crushing to the ore, reducing same to 2½-ring before it leaves the mine. In order to bypass the ore through the jaw-crusher it has been necessary to place a heavy reinforced-concrete bulk-head in the Main 68 ore-raise, which directs the ore to the crusher, which in turn discharges its crushed product into the ore-raise below the bulk-head.

"Practically all the development-work done was in the *Victoria* section of the mine, east of the *Fairview* and *Empress*, opening a new body of ore. On the 1,900-foot level a winze is being sunk, through which the ore will be hoisted from the levels below. An aerial tramway is under construction to handle this ore from the *Victoria* to the portal of the 1,600-foot level of the *Empress*.

"Near the entrance to the *Victoria* mine there has been erected a 30,000-foot-capacity sawmill, from which timbers are handled directly to the workings. A 3-story, 30- by 100-foot bunkhouse and a 25 by 40 dry-house have been built to house and care for about sixty-five men.

"During the year the 1,500-foot raise from the 4,100-foot level (elevation top of mill-bins) to the 2,700-foot level (elevation head of incline) was holed through, and is now being put in shape to handle by gravity the total output of the mine, thus eliminating the incline railway as an ore-carrier. No ore is being drawn from the mine at the present time.

"No milling operations were conducted during the year, and on March 19th our Beach concentrator was destroyed by fire of an unknown origin. Shipment was, however, made during 1922 of the following tonnages to the Tacoma smelter, cleaning up the product which was on hand in our bunkers at the close of the year: Tons of ore and concentrates shipped, 6,502, containing 646 oz. gold, 8,362 oz. silver, and 1,476,395 lb. copper.

"Contract has recently been closed with the Canadian Northwest Steel Company for the erection of a 2,500-ton steel-mill to replace the one above mentioned, and it is our intention to install in this fire-proof building the most modern type of milling machinery, embodying equipment much larger than that formerly used. We hope to have the mill in operation during the fall of the present year."

As the details of the horrible accident occurring on October 28th through flood conditions are fresh in your mind, I will not incorporate same in this report.

J. H. Thompson informs me that during the past year his company has been shipping bog-iron ore from its mines near Mons to the gasworks at Tacoma and Seattle, and that arrangements have been completed to ship ore to other gas plants in the Coast States and this Province. This ore is being used as a purifier, and after severe tests and comparisons with other purifiers has been found a much better article.

Conuma River, Nootka Sound.

Powell Lake, Nanaimo M.D.

From the numerous inquiries made and the widespread interest being taken in mining matters here, the coming season promises to be a busy one among the miners all over the Province.

Office Statistics—Vancouver Mining Division.

Free miners' certificates issued	1,698
Free miners' certificates (special)	13
Free miners' certificates (company)	67
Quartz claims recorded	56
Abandonment recorded	1
Certificates of work issued	226
Surveys recorded as work	2
Receipts issued for money in lieu of work	36
Group notices filed	29
Documents filed	5
Conveyances recorded	19

Revenue.

Free miners' certificates	$13,010 30
Mining receipts	4,414 90
Total	$17,425 20

NEW WESTMINSTER MINING DIVISION.

Report by Irving Wintemute, Mining Recorder.

I have the honour to submit the following report of mining operations in the New Westminster Mining Division for the year ending December 31st, 1921:—

The mineral claims located and recorded during the year are situate in the following places throughout the New Westminster Mining Division: Harrison lake, 35; Jones creek, 8; Agassiz, 5; Pitt lake, 16; Chilliwack lake, 1; Lillooet river, 26.

There has been a slight increase in the number of claims recorded over the previous year, while the assessment-work recorded shows a considerable falling-off.

There have been no new developments in the district worthy of special report. Very little has been done beyond some prospecting in the vicinity of Harrison lake and also at Lillooet river and vicinity, where several new claims were located and recorded.

Prospecting for oil has been continued during the year by the Boundary Bay Oil Company, Limited, at Boundary bay, and the Empire Oil and Gas Company near Aldergrove. I am indebted to S. A. Thompson, manager of the Boundary Bay Oil Company, Limited, for the following report of the company's operations at Boundary bay:—

"The Boundary Bay Oil Company, Limited, was formed in 1918 for the purpose of sinking a well to test the Boundary Bay section for oil and natural gas. Prior to the starting of a deep test a number of shallow wells were sunk to gather information of the structural conditions existing. A location on Lot 578, New Westminster District, was decided on. This location is on the tidal flats of Boundary bay and being about 15 miles in a south-easterly direction from the city of Vancouver.

"During the year of 1920 a well was sunk to the depth of 2,473 feet and was finally abandoned owing to casing trouble. The geological conditions encountered were favourable and indicated that a deeper test should be put down on a location in the immediate vicinity.

"The 116-foot derrick used on well No. 1 was moved 65 feet and well No. 2 was started on the 5th day of April, 1921. At the time of making this report, January 25th, 1922, a 10-inch hole had been sunk to a depth of 3,831 feet.

"The conglomerates met at a depth of 2,150 feet evidently mark the lowest strata of the Pliocene, and the 36-foot limestone and marine shells thereafter entered by the drill evidently mark the upper strata of the Miocene. Shells of Lamellibranchs from this horizon appear to be the *Tellina (Angulus) producta* of Conrad, and a broken fragment of a larger shell appears to represent the *Spisula (Hemimactra) marylandica* of Dall.

"At a depth of 2,417 feet a sand carrying gas under considerable pressure was encountered. An analysis of the gas gave the following results:—

	Per Cent.
Paraffins (mainly methane)	85.2
Ethane	Trace.
Oxygen	3.2
Nitrogen	11.4
Carbon	None.
Carbon dioxide	Trace.

"The above results show that the sample submitted is chiefly natural gas mixed with about 14 per cent. of air.

"From 2,500 feet down to 3,831 feet was found a series of brown shales, blue shales, limestones, brown gumbo, gypsum, blue gumbo, black bituminous shales, steatite, shale and shells, chalk rock, yellow gumbo, sandy shales, and sandstone. Below the 3,700-foot horizon 130 feet of sandy shale and sandstone all carried gas under very high pressure, and also some oil of high gravity and of a paraffin base.

"The drilling equipment is composed of a No. 5 Union Tool rotary. The motive power is supplied by two horizontal tubular boilers (120 horse-power) connected with a 12- by 12-inch engine and two 12- by 6¾- by 12-inch mud-pumps."

OFFICE STATISTICS—NEW WESTMINSTER MINING DIVISION.

Free miners' certificates issued	171
Mineral claims recorded	91
Certificates of work issued	65
Conveyances, etc., recorded	33
Grouping notices filed	3
Certificates of improvements issued	1

Revenue.

Free miners' certificates	$ 726 00
Mining receipts	594 30
Total	$1,320 30

INSPECTION OF MINES.

REPORT BY JAMES MCGREGOR, CHIEF INSPECTOR.

I have the honour to submit my annual report as Chief Inspector of Mines for the Province for the year 1921.

Appended are the District Inspectors' reports on the condition of the mines in their respective districts in regard to safety and sanitation, the number of persons employed in and around the coal and metalliferous mines, the tonnage of coal mined, lists of fatal accidents and prosecutions, and the reports of the Instructors in Mine-rescue and First-aid Work.

PERSONNEL OF STAFF OF INSPECTORS AND INSTRUCTORS.

Inspectors.

James McGregor	Chief Inspector.
Robert Strachan	Senior Inspector, Fernie (Kootenay and Boundary Districts).
John McDonald	Inspector, Fernie.
H. H. Johnstone	Temporary Inspector, Rossland.
Henry Devlin	Inspector, Nanaimo.
Thomas R. Jackson	Inspector, Nanaimo.
J. G. Biggs	Inspector, Merritt.
Thomas J. Shenton	Inspector, Prince Rupert.

Instructors, Mine-rescue Stations.

J. T. Puckey	Instructor, Fernie.
John D. Stewart	Instructor, Nanaimo.
John Thompson	Instructor, Cumberland.
W. C. Stone	Instructor, Middlesboro.

By amendment to the "Coal-mines Regulation Act" during 1919 the Board of Examiners for coal-mine officials and miners was placed under the jurisdiction of the Inspection Branch. The personnel of the Board of Examiners for coal-mine officials is as follows:—

James McGregor, Chairman.
James Dickson, Secretary, Member of Board, and Acting Inspector of Mines.
Harry E. Miard, Member of Board and Acting Inspector of Mines.

Messrs. Dickson and Miard and the District Inspector for the district in which an examination is being held form the Board for granting certificates of competency to coal-miners. An Inspector of Mines is empowered to grant provisional certificates to miners for a period not exceeding sixty days between regular examinations.

There have been no changes in the inspection staff and no new appointments made during the year.

TONNAGE OF COAL PRODUCED.

The gross tonnage mined by the coal-mines of the Province for the year 1921 amounted to 2,569,639 tons, being a decrease from the previous year of 127,135 tons, mainly due to stagnation of general trade, there being no labour troubles, strikes, or lock-outs during the year.

The Coast District, which includes Nicola-Princeton, Vancouver Island, and Aveling, produced 1,809,884 tons, a decrease of 39,501 tons compared with the previous year.

The Vancouver Island collieries produced during the year 1,625,931 tons, showing a decrease compared with the previous year of 72,323 tons.

The Aveling mines in the Northern District produced 800 tons for the year, being a decrease compared with the previous year of 600 tons.

The Crowsnest Pass District produced during the year 759,775 tons, being a decrease of 87,634 tons compared with the previous year. The principal decrease was at the Corbin mines, which had a decrease of 83,683 tons out of a total decrease for the district of 87,634 tons.

ACCIDENTS IN COAL AND METALLIFEROUS MINES.

The compilation of tables showing number and character of accidents in coal and metalliferous mines in British Columbia is undertaken by the Workmen's Compensation Board under

the "Workmen's Compensation Act." The fatal accidents only will be dealt with in my annual report in connection with tonnage and persons employed, as shown by the following tables.

FATAL ACCIDENTS IN AND AROUND COAL-MINES.

The fatalities in and around coal-mines during the year totalled ten. There were 6,885 men employed in and around the coal-mines.

The ratio of accidents per 1,000 persons employed was 1.45, compared with 2.67 in 1920; in 1919 the ratio was 2,103, in 1918 the ratio was 5,159, and in 1917 it was 8.51. The ratio for the last ten years was 4.81.

The following table shows the collieries at which fatal accidents occurred during 1921, and their relation to accidents which occurred in 1920:—

Name of Company.	Name of Colliery.	1921.	1920.
Canadian Collieries (D.), Ltd	Comox	4	3
Canadian Collieries (D.), Ltd	Extension	1	2
Western Fuel Corporation of Canada	Nanaimo	..	4
Pacific Coast Coal Mines	South Wellington	..	2
Middlesboro Collieries Co.	Middlesboro	..	1
Crow's Nest Pass Coal Co.	Coal Creek	2	2
Crow's Nest Pass Coal Co.	Michel	..	1
Granby Collieries	Cassidy	3	2
Totals		10	17

The following table shows the various causes of fatal accidents in coal-mines and the percentage of the whole, with corresponding figures for the previous year:—

Cause.	1921.		1920.	
	No.	Per Cent.	No.	Per Cent.
Fall of rock	6	60	8	47.06
Mine-cars and haulage	4	40	5	29.42
Fall of coal	..	..	2	11.76
Material falling in shaft	..	..	1	5.88
Fell from scaffold	..	..	1	5.88
Totals	10	100	17	100.00

The number of tons of coal mined for each fatal accident during the year 1921 was 256,963 tons, compared with 158,633 tons in 1920.

FATAL ACCIDENTS IN METALLIFEROUS MINES.

There were three fatal accidents in the metalliferous mines of the Province during the year 1921, being a decrease of two compared with the year 1920.

There were 2,099 persons employed in and around the metalliferous mines, a decrease of 1,242 compared with the previous year. Fatal accidents were three.

The ratio of fatal accidents per 1,000 persons employed was 1.43, compared with 1.54 in 1920. The ratio for the last ten-year period was 2.89.

The mines at which fatalities occurred are:—

Mining Division.	Mine.	No. of Accidents.
Slocan	Rambler-Cariboo	1
Skeena	Surf Inlet	1
Vancouver	Britannia	1
Total		3

The following table gives the cause and percentage to the whole of the fatal accidents in metalliferous mines, with corresponding figures for 1920:—

Cause.	1921.		1920.	
	No.	Per Cent.	No.	Per Cent.
Falls of ground	2	66.67	2	40.00
By falling into chutes, raises, winzes	..	....	1	20.00
By mine-cars and haulage	1	33.33	..	....
Material falling in shaft	..	....	..	....
By cage in shaft	..	....	1	20.00
By explosion of powder	..	....	..	....
By explosion of gas	..	....	..	....
Miscellaneous (surface)	..	....	1	20.00
Totals	3	100.00	5	100.00

There were two fatal accidents from falling ground in metalliferous mines during the year 1921 and one from mine-cars and haulage.

There were no fatal accidents from explosions of powder, making four years in succession without a fatal accident from that cause.

The output from the metalliferous mines for the year 1921 was 1,562,645 tons, compared with 2,178,187 tons in 1920, showing a decrease of 615,642 tons.

The number of tons of ore mined for each fatal accident in 1921 was 520,881 tons, compared with 435,637 tons in 1920, an increase of 85,244 tons.

Explosives.

The following table shows the quantity of explosives used in the coal-mines of the Province during the year 1921, together with the number of shots fired, how shots were fired, tons of coal produced by pound of explosive used, and the average pounds of explosive per shot fired:—

District.	Quantity of Explosive used in Pounds.	Tonnage for District.	No. of Shots fired by Electricity.	No. of Shots fired by Fuse.	Total No. of Shots fired.	Tons of Coal per Pound of Explosive.	Average Pounds of Explosive per Shot fired.
Vancouver Island	483,964	1,811,618	650,290	...	650,290	2.79	0.74
East Kootenay	25,128	759,755	32,803	...	32,803	30.00	0.75
Nicola-Princeton	73,812	183,153	92,680	...	92,680	2.48	0.79
Northern District	.....	.....	.....	...	.....	... ..	....
Totals	582,904	.....	775,773	...	775,773	4.41	0.75

The production of coal per pound of explosive used is less than that of the previous year.

The East Kootenay District shows a decrease of 24.72 tons per pound of explosive used, the yield being 12.56, compared with 37.28 tons for 1920. This is entirely accounted for by the Corbin mines having abandoned the quarrying or steam-shovelling system, having now commenced mining under cover.

The Nicola-Princeton District shows a decrease of 0.63 ton per pound of explosive used, the yield being 3.11 tons, compared with 3.74 tons in 1920.

The Vancouver Island mines show a decrease of 0.46 ton per pound of explosive used, the yield being 2.79 tons, compared with 3.25 tons in 1920.

The estimated yield at Aveling is 4 tons per pound of explosive used.

During the year 1921 one additional explosive was added to the permitted list for British Columbia, known on the United States permitted list as Coalite "E" L.F. This powder is

manufactured by the Giant Powder Company. The full list of explosives now permitted is as follows:—

Monobel A1	British List.
Monobel No. 1	"
Dynobel No. 4	"
Polar Permitite	"
Coalite "E" L.F.	United States List.
Monobel	" "
Coalite "A" L.F.	" "
Monobel No. 4	" "
"Giant" Coal-mine Powder No. 5	" "
"Giant" Coal-mine Powder No. 6	" "
"Giant" Coal-mine Powder No. 7	" "
"Giant" Coal-mine Powder No. 8	" "
"Giant" Coal-mine Powder No. 9	" "
Polar Brushite	" "
Vigorite No. 1	" "
Vigorite No. 2	" "
Vigorite No. 3	" "
Vigorite No. 4	" "
Miner's Friend No. 1	" "
Miner's Friend No. 2	" "
Miner's Friend No. 3	" "
Miner's Friend No. 6	" "
Miner's Friend No. 7	" "
Viking No. 1	" "

SAFETY-LAMPS.

The following table shows the distribution of lamps by districts, method of locking, and the illuminant used:—

District.	Magnetic.	Screw or Automatic Clip.	Naphtha.	Electricity
Crowsnest Pass	100	1,292	100	1,292
Nicola-Princeton	59	495	59	495
Vancouver Island	487	2,937	487	2,937
Totals	646	4,724	646	4,724

The Edison electric cap-lamp is still finding great favour, both with the operator and workmen underground, and has proven beyond the experimental stage to be a very efficient and safe lamp.

MINE-AIR SAMPLING.

The same system in taking air samples has been followed as in the past year throughout the Province. Careful checking has been continued between the chemical analysis received from the laboratory at Ottawa and the results from the Burrell gas-detector in use in the different mines of the Province. The difference between the test made at the laboratory at Ottawa and the readings of the Burrell gas-detector with reference to the amount of CH_4 contained in the mine atmosphere does not vary more than one-tenth of 1 per cent.

The Inspector of each coal-mining district is supplied with the Burrell gas-detector, also each of the coal-mining companies have them in use for making its own tests.

During the year 1919 the Hon. William Sloan, Minister of Mines, had a chart prepared in booklet form and issued to the officials and workmen, showing the length of flame-cap on a Wolf safety-lamp for the different percentages up to 2½ per cent. This chart was compiled from actual tests covering nearly two years.

The following table shows the data obtained from the mine-air samples in coal-mines during the year 1921:—

Returns from Mine-air Samples taken in the Various Coal-mines of the Crowsnest District during the Year 1921.

Sample No.	Date	Mine.	Ventilating District.	Working or Idle.	Tonnage per Day.	Tonnage of Split per Day.	Chemical Analysis.				Velocity of Air in Feet per Minute.	Quantity of Air in Cubic Feet per Minute.	Barometer.	Hygrometer.			Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
							CO_2.	O.	CH_4.	N.				Wet Bulb.	Dry Bulb.	Humidity.			
		Coal Creek.											"	'	'	%			
746	Jan 5..	No. 1 South..	Main return	Working .	350	....	0.25	20.07	1.35	78.32	430	25,800	25.20	61.0	62.0	93	388	588,720	1,593
752	" 24..	No. 3.....	South Line split.	" .	320	160	0.16	20.55	0.80	78.49	415	20,750	25.90	61.0	63.0	88	166	239,040	896
753	" 24..	No. 3.....	Main return	" .	320	....	0.21	20.43	0.97	78.39	900	54,000	25.90	61.0	62.0	93	523	753,120	2,350
757	Feb. 9..	No. B Seam..	"	" .	200	....	0.12	20.56	0.78	78.54	600	42,000	25.90	48.0	49.0	93	334	480,960	2,404
763	" 16..	No. 1 South .	"	" .	375	....	0.22	20.28	0.81	78.69	470	28,200	26.00	60.0	61.0	93	218	117,720	322
766	" 18..	No. 2..	"	" .	350	....	0.24	20.45	0.25	79.06	470	35,250	26.20	54.5	55.0	97	88	126,720	362
771	Mar. 15..	No. 1.....	Whole mine	" .	250	....	0.34	20.31	0.24	79.11	410	17,220	25.90	60.0	61.0	93	41	59,040	236
772	" 15..	No. 9..... .	Main return	" .	20	....	0.32	20.67	0.32	78.91	180	9,000	25.90	48.0	49.0	93	2	2,880	144
775	" 17..	No. 2.....	"	" .	350	....	0.25	20.34	0.65	78.76	500	37,520	25.60	52.0	52.0	100	244	348,480	996
778	" 22..	No. B North.	"	" .	220	....	0.18	20.49	0.91	78.42	600	40,800	26.00	48.0	49.0	93	371	534,240	1,427
784	" 23..	No. 1 East...	"	" .	500	....	0.15	20.41	0.89	78.55	1,450	120,300	25.60	52.0	53.0	97	1,070	1,540,800	3,081
787	" 24..	No. 3.....	"	" .	325	....	0.18	20.40	1.11	78.31	840	50,400	25.70	62.0	63.0	93	559	804,960	2,476
796	April 21..	No. 3.....	"	" .	325	....	0.14	20.60	0.63	78.63	900	54,000	25.70	61.0	62.0	93	336	3,402,000	1,047
797	" 25..	No. 1 South .	"	" .	375	....	0.27	20.13	0.99	78.61	460	27,600	25.70	61.0	62.0	93	273	378,120	995
804	May 17..	No. 3..... ..	"	" .	325	...	0.30	20.35	1.02	78.33	820	49,200	25.80	61.0	62.0	93	497	715,680	2,202
808	" 23 .	No. 1 East...	2nd South.....	" .	...	135	0.14	20.39	1.58	77.89	300	21,000	26.10	51.0	52.0	93	331	506,640	963
805	" 23..	No. 1 East...	Main return	" .	525	...	0.15	20.49	0.55	78.81	1,300	117,000	26.10	52.0	53.0	93	643	925,920	1,675
828	June 13..	No. 1 East...	"	" .	828	500	0.15	20.39	1.11	78.35	1,500	124,500	26.50	56.0	57.0	93	1,381	1,988,640	3,859
840	Aug. 1..	No. 2.....	"	" .	300	....	0.27	20.32	0.56	78.85	480	40,800	26.00	61.0	62.0	93	228	329,320	1,097
845	" 12..	No. 1 East...	"	" .	635	....	0.19	20.34	1.12	78.35	1,450	120,350	26.20	56.0	57.0	93	1,347	1,939,680	3,054
856	Sept. 8..	No. 1 East...	1st South split.....	" .	...	105	0.19	20.26	1.32	78.23	350	26,250	25.80	58.0	59.5	90	346	498,240	1,465
858	" 8..	No. 1 East...	Main return	" .	340	....	0.20	20.29	0.82	78.69	1,550	116,250	25.80	57.0	58.0	93	953	1,361,320	4,003
870	" 21..	No. 1 South .	"	" .	400	....	0.38	19.96	1.35	78.31	240	21,600	25.00	61.0	62.0	93	201	290,240	725
881	Oct. 13..	No. 1 South .	Main return, S. Right.	" .	400	....	0.15	20.51	0.35	78.89	250	22,500	25.75	66.0	67.0	93	78	112,320	288
885	" 26..	No. B North.	Main return	" .	275	....	0.15	24.43	1.02	78.40	700	42,000	25.60	50.0	51.0	93	492	617,760	2,246
899	Nov. 14..	No. 2..	Main return junction..	" .	300	....	0.22	20.33	0.55	78.90	560	47,600	25.60	58.0	59.0	93	261	375,840	939
891	" 4..	No. 1 North..	Main return	" .	280	....	0.35	20.20	0.24	79.21	400	20,000	26.00	60.0	61.0	93	48	68,920	245
903	" 15..	No. 9.....	Main return Counter..	" .	30	....	0.10	20.61	0.20	79.09	190	9,500	25.50	57.0	58.0	93	19	27,360	912
908	Dec. 1..	No. 3.....	Slope split, 3 slope....	" .	...	250	0.15	20.47	0.89	78.49	380	24,320	25.50	61.0	62.0	93	216	311,040	1,244
910	" 1..	No. 3.....	Main return	" .	350	....	0.22	20.31	1.35	78.14	890	53,400	25.50	59.0	60.0	93	710	1,022,400	2,921
916	" 14..	No. B North.	"	" .	275	....	0.19	20.39	1.01	78.41	750	48,750	26.00	51.0	51.0	100	492	708,480	2,579
			Michel.																
329	Jan. 26..	No. 3 East...	Main return	Working .	300	....	0.14	20.42	1.27	78.27	1,700	107,100	25.55	51.0	51.0	100	199	286,550	955
345	Feb. 4..	Upper No. 3..	"	" .	300	...	0.11	20.42	1.42	78.05	1,800	113,400	25.80	50.0	50.0	100	255	367,200	1,224
351	Mar. 16..	No. 3 East...	West side.	" .	140	....	0.11	20.48	1.16	78.25	1,040	54,080	26.80	48.0	48.5	97	626	901,440	3,034
355	April 28 .	No. 3 East...	Upper No. 3	" .	...	160	0.10	20.49	1.37	78.04	660	39,600	26.00	....	....	...	542	780,480	2,601
354	" 28 .	No. 3 East, Main slope	Return airway.....	" .	300	....	0.12	20.38	1.58	78.92	1,000	50,000	26.00	....	....	...	790	1,137,600	3,792
368	July 26..	No. 3.....	6 East split.....	" .	...	160	0.21	20.37	1.37	78.05	200	19,200	26.02	55.0	55.0	100	263	369,920	2,312
373	Aug. 10..	No. 3.....	Main return	" .	525	....	0.24	20.40	0.65	78.71	620	62,000	26.20	55.0	55.0	100	223	321,120	611
376	" 23..	No. 3 East...	"	" .	350	....	0.14	20.50	1.09	78.27	1,600	100,800	26.00	52.0	52.0	100	1,098	1,569,600	4,480
377	" 30..	No. 8.....	"	" .	650	....	0.26	20.44	0.13	79.17	480	33,600	25.25	51.5	52.0	97	43	61,920	90
387	Oct. 21..	No. 3.....	"	" .	565	....	0.25	20.31	0.70	78.74	640	64,000	25.70	....	....	...	448	645,120	1,141
394	Nov. 1..	No. 3.....	"	Idle.....	575	....	0.12	20.56	0.39	78.93	1,150	115,000	26.30	49.0	50.0	93	448	634,120	1,102

BUMPS IN COAL-MINES.

The disturbances in the different coal-mines of the Province known as "bumps" or "blow-outs" have not been so severe during the year 1921 as they were in 1920; especially in the Crowsnest Pass District, where they have quite a number, none of them doing any great damage, other than displacing a few sets of timbers and dislodging a small quantity of coal from the face or sides and liberating large quantities of methane. There have been no injuries from that cause during the year.

In the Granby No. 1 mine at Cassidy, on Vancouver island, similar disturbances have occurred frequently during the year, dislodging large quantities of coal from the face and sides of headings, giving off methane freely, but the flow of methane does not continue for any great length of time, the rush of methane being over generally in a few hours. There have been no injuries from that cause up to the present, every precaution being taken when an outbursts occurs, both in the Crowsnest Pass mines and the Island mine, to prevent accidents.

MINE FIRES.

There have been no serious outbreaks of fires in the mines during the year. Those which have been walled off were carefully guarded and kept under control.

EXPLOSIONS.

There have been no explosions during the year 1921.

MINE-AIR SAMPLES.

There have been a great many mine-air samples taken at the Crowsnest Pass coal-mines during the year and analysed at the Bureau of Mines at Ottawa. The results of many of these tests are published in this report. This important work done in this respect by the Bureau of Mines at Ottawa is much appreciated by the Department of Mines, especially as it is gratuitously performed.

CARBON-MONOXIDE DETECTORS.

During the year 1920 the carbon-monoxide detector was perfected by Mr. Burrell, of the United States, member of the Bureau of Mines. This will be an assistance in detecting a small percentage of the dangerous gas given off during mine fires or heavy exposions of powder underground.

As soon as the instrument was accepted by the Bureau of Mines of the United States, the Hon. William Sloan, Minister of Mines, ordered one for each rescue-station in the Province.

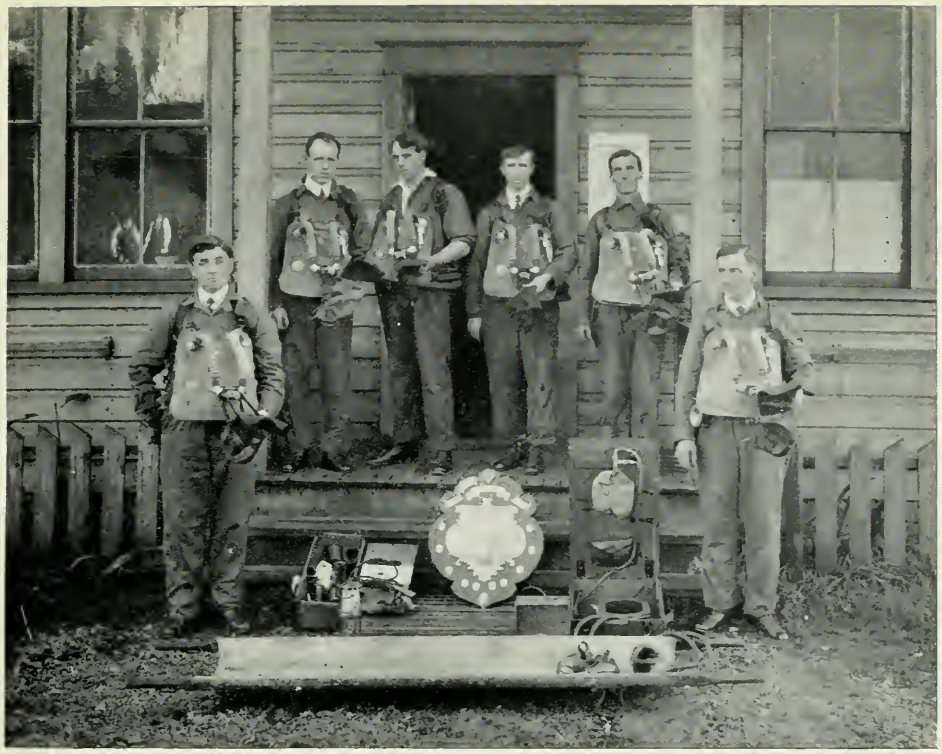
MINE-RESCUE WORK.

Instruction in mine-rescue work has been actively and effectively maintained at the different rescue-stations throughout the Province during the year.

There were quite a number of men who took the course and qualified for certificates of competency; also a number who had qualified in previous years kept up their training during the year. At the present time there are 499 men who have qualified and secured certificates issued by the Mines Department.

The training course necessary to qualify for a certificate of comptency consists of wearing the oxygen breathing apparatus for two hours a day for twelve days in an irrespirable atmosphere, performing considerable work while there, in addition to spending many hours familiarizing themselves with the many parts of the apparatus, testing of the apparatus for defects, and assembling it in the shortest time.

These volunteers deserve great credit for taking this course of training, as they do so without remuneration.



Cumberland Mine-rescue Squad.

Cumberland First-aid Squad.

List of Persons who have received Mine-rescue Certificates during 1921.

Name.	Certificate No.	Where trained.
Weaver, William	485	Fernie.
Talbot, William	486	"
Brown, G. A.	487	"
Tombassio, Jesippi	488	"
Lese, George	489	Merritt.
Cartwright, William David	490	"
Simm, James	491	"
Waddington, George	492	"
Ewart, William	493	"
Adamson, William	494	"
Robertson, George	495	"
Whitehead, John	496	"
Rudrum, Wonderfull A.	497	"
Lester, Frank	498	"
Smith, John Watterson	499	"

The following table shows the number, distribution, and type of mine-rescue apparatus and oxygen resuscitating devices maintained at the coal-mines of the Province during the year 1921:—

Company.	Draeger Apparatus.		Proto or Fleuss Apparatus.		Gibbs.	Paul.	Total Apparatus.	Resuscitating Devices.			Total.
								Pulmotor.		Lung-motor.	
	2-hour.	1-hour.	2-hour.	1-hour.				Type A.	Type B.		
Canadian Western Fuel Co.	4	..	4	2	6	..	16	2	..	2	4
Canadian Collieries—											
Extension	4	..	..	..	..	..	4	..	1	..	1
South Wellington	..	..	..	..	..	5	2	..	1	..	1
Comox	4	..	..	..	..	..	4	..	1	..	1
Vancouver-Nanaimo Coal Co.	2	1	..	..	..	..	3	1	..	..	1
Pacific Coast Coal Mines, Ltd.	2	2	..	..	2	..	6	1	..	..	1
Granby C. M. S. & P. Co.	4	..	..	..	..	..	4	..	..	1	1
Middlesboro Collieries	2	1	..	..	..	..	3	1	..	..	1
Fleming Coal Co.	2	2	..	.	..	..	4	1	..	..	1
Merritt Colliery	..	2	..	..	2	..	4	..	..	..	..
Princeton Colliery	1	1	..	..	..	..	2	1	..	..	1
Crow's Nest Pass Coal Co—											
Coal Creek	5	6	..	..	6	..	16	2	..	..	2
Michel	5	5	..	..	..	..	10	1	..	..	1
Corbin Coal & Coke Co.	2	1	..	..	..	..	3	1	..	..	1
B.C. Government	11	10	..	..	12	11	44	4	4	..	8
Totals	48	31	4	2	28	16	125	15	7	3	25

First-aid Work.

The enthusiasm in this work is quite the reverse of that displayed in mine-rescue work; a growing interest is manifested in first-aid training in many branches of industry, and we have now, especially around the coal-mining centres, first-aid teams who have demonstrated they are equal to any teams on the continent, which means a great amount of good can be accomplished in and around the mining centres and other industrial plants.

Machine-mined Coal.

During the year mining-machines produced 132,864 tons of coal, or 5.16 per cent. of the whole. This is a decrease compared with the amount of machine-mined coal in 1920, when the percentage of machine-mined coal was 5.51. Of the total machine-mined coal, the Canadian Western Fuel Company produced 42,720 tons, or 32.15 per cent.; the Canadian Collieries (D.), Limited, produced 77,184 tons of machine-mined coal, or 58.10 per cent.; the Crow's Nest Pass Coal Company produced 7,800 tons of machine-mined coal, or 5.90 per cent.

The Princeton Coal and Land Company did not produce any machine-mined coal during the year, while it produced 20,717 tons in 1920. In 1921 the output for the year, amounting to 13,966 tons, was principally taken from pillars where coal-cutting machines would be useless. The Nanoose Collieries produced 3,000 tons, or 2.30 per cent.; Chu Chua Collieries produced 2,160 tons, or 1.55 per cent.

The following table gives the district, number of machines, how driven, tons of coal produced, and type of machine:—

District.	Types of Machine in Use.		Tons of Coal produced.		Total Tons.
	Compressed Air.	Electricity.	Electricity.	Compressed Air.	
Vancouver Island	9	4	77,184	45,720	122,904
Nicola-Princeton	2	..	.....	2,160	2,160
Crowsnest Pass	3	..	.....	7,800	7,800
Totals	14	4	77,184	55,680	132,864

EXAMINATIONS FOR COAL-MINE OFFICIALS.

The "'Coal-mines Regulation Act," as now consolidated and amended, provides that all officers of a coal-mining company having any direct charge of work underground shall hold Government Certificates of Competency, which are to be obtained only after passing an examination before a duly qualified Board appointed for the purpose of holding such examinations, and known as the Board of Examiners.

The certificates granted on the recommendation of such Board and the requirements shall be as follows:—

"(*a.*) If a candidate for a manager, that he is a British subject and has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-five years of age; or, if he has taken a degree in scientific and mining training, including a course in coal-mining at a university or mining school approved by the Minister of Mines, that he has had at least four years' experience in and about the practical working of a coal-mine:

"(*b.*) If a candidate for overman, that he has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-three years of age:

"(*c.*) If a candidate for shiftboss, fireboss, or shotlighter, that he has had at least three years' experience in and about the practical working of a coal-mine, is the holder of a certificate of competency as a coal-miner, and is at least twenty years of age:

"(*d.*) A candidate for a certificate of competency as manager, overman, shiftboss, fireboss, or shotlighter shall produce a certificate from a duly qualified medical practitioner or St. John or other recognized ambulance society, showing that he has taken a course in ambulance-work fitting him, the said candidate, to give first aid to men injured in coal-mine operations:

"(*e.*) If a candidate for a certificate of competency as a mine surveyor, that he has had two years' practical experience in the surveying of mines, or is the holder of a diploma in scientific and mining training after a course of study of at least two years at an educational institute approved by the Minister of Mines, or has taken a degree in scientific mining subjects at a university so approved.

"'For the purposes of this section the experience demanded by such section shall be of such character as the Board shall consider of practical value in qualifying the candidate for the position to which such class of certificate applies.

"'Experience had in a mine outside of the Province may be accepted should the Board consider such of equal value."

Any certificate is considered as including that of any lower class.

EXAMINATION FOR MINERS.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. By "miner" is meant "a person employed underground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery."

Examinations of applicants for certificates of competency as coal-miners shall be conducted and certificates of competency granted by a Board of Examiners, which shall consist of the Inspector of Mines for the district in which the examination is held, and two other members to be appointed by the Minister, one of whom shall be appointed to represent the mine-owners and one to represent the coal-miners. The two appointed members of the Board shall have jurisdiction in all districts throughout the Province. The Minister shall appoint one of the appointed members to be Chairman and the other to be Secretary of the Board, and they shall hold office during the pleasure of the Minister.

Where any member of the Board of Examiners is unable to act at any examination by reason of illness, absence, or other cause, the Minister may appoint a person to act in the stead of that member for that occasion, or until the termination of the disability, and any person so appointed may complete any unfinished business of the Board in which he has taken part, even if the member in whose stead he has acted has become able to act.

The proceedings of the Board of Examiners shall be in accordance with the rules in the Third Schedule to the Act.

Examinations of applicants for certificates of competency as coal-miners shall be held on at least one day in every period of sixty days at each colliery designated by the Minister as a place for the holding of examinations under this section.

The work of the Board of Examiners in examining candidates for coal-miners' certificates has been carried on in all mining districts at intervals of less than sixty days, as required by the amendment of the Act.

No certificates have been granted in any case where the candidate failed to satisfy the Board as to his general fitness, experience in a coal-mine, and a working knowledge of the English language.

During 1921 seventy-six examinations were held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province and 456 certificates issued. In addition to above, a number of duplicate certificates were issued to coal-miners who had lost their original certificates of competency.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

First-, Second-, and Third-class Certificates.

Report of James Dickson, Secretary of Board.

I have the honour to submit herewith the annual report of the transactions of the above Board for the year ending December 31st, 1921.

The Board of Examiners, which was formed on July 1st, 1919, at present consists of James McGregor, Chief Inspector of Mines, as Chairman; Harry Ernest Miard, member; and James Dickson, member and Secretary of the Board.

The meetings of the Board are held in the office of the Board, Mines Department, Victoria. The first work was the drafting of the following rules for the conduct of examinations for certificates of competency as mine officials:—

Rules made by the Provincial Board of Examiners, July 16th, 1919, and approved by the Minister of Mines, July 16th, 1919, under Section 38 of the "Coal-mines Regulation Act, 1911," and Amendment Act, 1919, for the Conduct of Examinations.

1. No application for examination will be considered from any candidate unless it is received by the Department of Mines at least fifteen days previous to the date on which the examination is to be held.

2. The examination sittings shall begin at 9 a.m. and continue until 12.30 p.m.; they shall resume at 2 p.m., and continue until 5.30 each day until the conclusion of the examination.

3. The examinations shall be conducted by the Presiding Examiners appointed by the Board.

4. The Presiding Examiners shall be present in the examination-room at least fifteen minutes prior to the time at which the examination commences.

5. Before each examination the question papers shall be prepared by the Examiners appointed by the Minister, and the necessary copies forwarded to the Presiding Examiners, each set of papers being in a separate sealed package.

6. At the time of the commencement of each session of the examination, when the candidates are in their respective places, the seal of the package shall be broken in the examination-room in the presence of the candidates and the papers distributed punctually in accordance with the time-table on the package.

7. Candidates must present themselves punctually at the hours appointed for the commencement of the examination, and no candidate will be allowed to enter the examination-room later than forty-five minutes after the time set for the commencement of the examination, nor will any candidate be allowed to leave the room during a sitting unless in case of extreme necessity.

8. When the time allotted to each paper has expired, the papers shall be collected by the Presiding Examiners and immediately placed in a package and sealed. At the completion of the examination these papers shall be forwarded to the office of the Board of Examiners for Coal-mine Officials, Victoria, B.C.

9. The examination shall be conducted strictly in accordance with these rules, and the papers of any candidate who does not comply with these rules may be cancelled at the discretion of the Board.

10. The Presiding Examiners shall see that the room is clear of all possible aid to the candidates, and that no persons other than the Honourable the Minister of Mines, the Deputy Minister of Mines, the Provincial Mineralogist, members of the Board, Inspectors of Mines, and Examiners be allowed in the examination-room during sessions.

11. All stationery required for the purpose of the examination shall be supplied by the Board. All surplus stationery shall be collected by the Presiding Examiners at the completion of the examination. Each candidate shall be supplied with pens, ink, pencils, and blotting-paper.

12. The papers shall be collected at the times indicated by the time-table. If from any cause a paper is not given out precisely at schedule time, the candidates must be informed of the fact and the exact time at which their work will be collected, and care must be taken that the exact time is allowed from the moment from which the paper was given out. The time consumed in collecting and giving out papers must not be included in the "full time" allowed for any paper. A candidate who attends late shall not be allowed any extension of time on that account.

13. Before proceeding to his seat in the examination-room a candidate shall lay aside his hat and overcoat, and any book, papers, or appliances the use of which is not expressly allowed to him. The candidate shall be allowed to bring with him a drawing-scale, slide-rule, protractor, a pair of compasses, and logarithmic and trigonometrical tables. Apart from such special articles, a candidate shall be at liberty to take to his place in the examination-room such ordinary appliances as pens, ink, penknife, chalks, and india-rubber; but the Presiding Examiners may, at their discretion, prohibit the use of any such articles.

14. If a candidate arrives late a note of the circumstances shall be made, and it shall always be stated whether any other candidate has already left the room.

15. The Presiding Examiners shall collect at the commencement of the examination the authorization obtained from the Department of Mines for appearing at the examination-room, and no candidate shall be allowed to enter the examination-room unless he presents such authorization.

16. Silence shall be observed in the examination-room while the examination is in progress.

17. The Presiding Examiners shall take every precaution to see that no candidate receives any improper assistance, either from books or papers or from any person. They shall check all disorderly or improper conduct in or about the room, enforce all rules for the conduct of the examination, and report to the Board any irregularity which may occur or any shortcoming in the arrangements for the examination.

18. Should it appear to the Presiding Examiners that a candidate has obtained improper assistance the papers of such candidate shall be cancelled. Any candidate giving assistance to another candidate shall be held to be equally guilty and shall be dealt with accordingly.

19. No candidate shall be allowed to leave the examination-room until the expiration of one hour after the time fixed for the commencement of the paper on which he is engaged.

A candidate obliged to leave the room through illness or other sufficient cause, and who wishes to return and continue work on the paper then in progress, shall leave the room in charge of a Presiding Examiner; a note as to the circumstances shall be made and the part of the paper at which the candidate was at work shall be endorsed by the Presiding Examiner, "The candidate left at this point."

Candidates shall not, without the express permission of the Presiding Examiners, remove from the examination-room any paper or other material supplied to them.

20. A candidate who asks a question as to any ambiguity in the papers shall be told to enter on his work any representation he may wish to make, but no further answer shall be given. The Presiding Examiners shall, themselves, forward a report to the Board stating the candidate's name and the general nature of the question.

A candidate making a complaint of any other nature shall be directed to make his statement in writing, which shall be sent to the Board.

21. Candidates shall be allowed, unless there is any special directions to the contrary, to keep their work in any subject until the expiration of the time allotted to that subject.

Every book, plan, form, or separate sheet of paper used by the candidate shall have inserted on it the name of the subject. The number of each question shall be inserted in the margin which shall be left along the left side of each sheet. In no case shall the name of the candidate be placed on any book, plan, form, or separate sheet of paper upon which the candidate has written or worked the answer to any question; but for the purpose of identification of papers the following system shall be used: At the commencement of the examination each candidate shall choose a number; he shall place this number on a slip furnished for this purpose, together with his name, and place the same in an envelope supplied for the purpose. These envelopes shall remain sealed until the paper has been examined. The candidate shall number all his examination papers with the number he has chosen and placed on the slip with his name.

22. Not more than one answer shall be written on the same sheet of paper. All answers shall be written in ink (except necessary diagrams, which may be in pencil) and on one side only of the paper, and each candidate shall enclose his question paper with his answers in the envelope supplied for the purpose.

23. After the Examiners have received the papers they will correct them and mark on them the marks obtained by each candidate for each paper.

24. After the examination the candidate will be furnished with a list of the marks obtained by him in the different subjects, but not the marks for the individual questions.

25. The apparent or presumed results of the examination shall not be communicated to any person until the same have been officially announced.

26. All correspondence intended for the Board must be addressed to the "Office of the Board of Examiners for Coal-mine Officials, Victoria, B.C."

27. The Presiding Examiners must see that the condidate obtains the right paper of questions.

28. All the work by which the results are obtained shall be clearly shown in immediate connection with the answer, so as to enable the Examiners to satisfy themselves that the candidate has understood the question and to see by what process the results were obtained. Anything which the candidate does not wish the Examiners to notice should be crossed out with pen or pencil, but not erased.

29. In the case of any applicant producing a certificate from a medical practitioner instead of from a recognized ambulance society, as provided for in section 41, subsection (*e*), such certificate shall be in the following form:—

"I hereby certify that I have examined , of , in ambulance-work, and find him qualified to render first aid to persons injured in or about a mine.

"(Signed.).....
"*Medical Practitioner.*"

30. The nature of the practical experience shall be experience gained in one or other of the following capacities in a coal-mine, or in a capacity which may be considered by the Board to be equivalent to:—

(*a.*) An underground official of a coal-mine—
(1.) In actual practical work at the working-face and other parts of the underground workings of a coal-mine:
(2.) In direct supervision of such work; or
(3.) In both (1) and (2); or

(*b.*) As an underground workman of a coal-mine who has had direct practical experience in the work of getting minerals, and of stonework, timbering, and repairing:

(*c.*) As mine surveyor. In the case of a person employed as mine surveyor, the practical experience will be considered to be the time the applicant has been employed underground in a coal-mine.

31. Candidates for certificates must possess such knowledge as will enable them to answer promptly questions on the following subjects:—

For First-class Certificates—
(1.) Mining Act and Rules:
(2.) Mine Gases:
(3.) Ventilation:
(4.) General Work:
(5.) Mining Machinery:
(6.) Surveying and Levelling.

For Second-class Certificates—
(1.) Mining Act and Rules:
(2.) Mine Gases:
(3.) Mine Ventilation:
(4.) General Work, including questions on underground machinery and surveying.

For Third-class Certificates—
(1.) Mining Act and Rules and Mine Gases:
(2.) Mine Ventilation and General Work.

For Mine Surveyors' Certificates—
Surveying, levelling, and drawing; determination of magnetic declination; loose and fast needle surveying underground and on the surface; calculation of areas and volume; contour lines and levelling; connecting of surface and underground surveys; triangulation; plotting by protractor and latitudes and departures; mine plans and sections; the use, care, and testing of the instruments.

32. A candidate for First-class Certificate of Competency must obtain 70 per cent. of the maximum marks obtainable for the first three subjects, Mining Act and Rules, Mine Gases and Ventilation; and 60 per cent. of the marks obtainable on the fourth, fifth, and sixth subjects—namely, General Work, Mining Machinery, Surveying and Levelling; and 70 per cent. of the marks obtainable for the whole examination.

33. A candidate for a Second-class Certificate of Competency must obtain 70 per cent. of the marks obtainable for the first three papers, Mining Act and Rules, Mine Gases, and Mine Ventilation; and 60 per cent. for the fourth subject, General Work; and 70 per cent. of the marks obtainable for the whole examination.

34. A candidate for a Third-class Certificate of Competency must obtain not less than 65 per cent. of the marks obtainable on the first subject, Mining Act and Rules and Mine Gases; not less than 60 per cent. of the marks obtainable on the second paper, Ventilation and General Work; and not less than 65 per cent. of the marks obtainable for the whole examination.

35. A candidate for a Mine Surveyor's Certificate of Competency must obtain 70 per cent. of the marks obtainable for the whole examination.

In view of the following regulation made pursuant to the provisions of the "Coal-mines Regulation Act" by the Lieutenant-Governor in Council, examinations for mine surveyors' certificates of competency were also held:—

REGULATION.

1. After the 1st day of October, 1919, all plans required to be kept in accordance with the provisions of the "Coal-mines Regulation Act" shall be made of durable material, and the surveying of mines and the preparation of mine-plans shall be done by a person or persons holding a certificate granted under the provisions of the "Coal-mines Regulation Act" and Amendment Acts.

2. In no case shall a certificate be granted to any applicant until he has satisfied the Board of Examiners that:—

(1.) He has had two years' practical experience in the surveying of mines, or is the holder of a diploma in scientific and mining training after a course of study of at least two years at an educational institute approved by the Minister of Mines, or has taken a degree in scientific mining subjects at a university so approved:

(2.) He is competent:—

(*a.*) To make an accurate survey of the workings of a coal-mine and to connect such survey with a surface survey:

(*b.*) To make accurate survey and levellings:

(*c.*) To plot accurately surveys and levellings:

(3.) He has given satisfactory evidence of his sobriety and general good conduct.

3. Each plan required to be kept in accordance with the provisions of the "Coal-mines Regulation Act" shall have inserted on it the date on which the last survey was made and the signature of the person making such survey.

4. A certificate authorizing any person to act as mine surveyor may be granted to such person without written examination if the Board of Examiners reports that he has the necessary experience, and provided application is made for such certificate before the 1st day of December, 1919.

5. Every person who violates any rule or regulation under the "Coal-mines Regulation Act" or Amendment Acts shall be guilty of an offence against the "Coal-mines Regulation Act," and liable to the penalties and obligations imposed by the said Act.

Two examinations for candidates for certificates of competency were held during 1921; the first being held on May 18th, 19th, and 20th, and the second on November 22nd, 23rd, and 24th.

The total number of candidates at these examinations was as follows: For First-class Certificates, 8 (2 passed, 6 failed); for Second-class Certificates, 8 (4 passed, 4 failed); for Third-class Certificates, 23 (15 passed, 8 failed); for Mine Surveyor Certificates, 6 (2 passed, 4 failed).

The work of the candidates, especially for the higher certificates, leaves much to be desired.

It is the intention of the Board to maintain a high standard, so intending candidates, to gain a certificate of competency of any class, must give themselves thorough preparation.

The following is a list of the candidates who successfully passed the examination in the various classes:—

First-class Candidates.—George Murray and Thomas Wright Scott.

Second-class Candidates.—Robert Clark, Thomas Wright Scott, Fred Menzies, and Hugh G. MacKinnon.

Third-class Candidates.—C. S. Congalton, William C. Stone, Peter Caldwell, David Coupland, Robert Alstead, Richard Dunnigan, George Davey, William R. Nee, William Chapman, George F. Nash, Thomas J. Shea, William Adamson, Thomas Dobie, Robert McArthur, and Cornelius Morgan.

Mine Surveyor Candidates.—Luke Lindoe and Lucas Verkirk.

REGISTERED LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY AS COAL-MINE OFFICIALS.

First-class Certificates of Competency issued under "Coal-mines Regulation Act, 1897."

Name.	Date.
Shepherd, Francis H	March 5th, 1881
Honobin, William	May 1st, 1882
Little, Francis D	May 1st, 1882
Chandler, William	December 21st, 1883
Priest, Elijah	December 21st, 1883
McGregor, James	January 18th, 1888
Randle, Joseph	January 18th, 1888
Matthews, John	January 8th, 1889
Norton, Richard Henry	August 26th, 1889
Sharp, Alexander	October 27th, 1891
Kesley, John	March 4th, 1892
Wall, William H	May 30th, 1896
Morgan, Thomas	May 30th, 1896
Wilson, David	May 30th, 1896
Smith, Frank B	May 30th, 1896
Bradshaw, George B	June 12th, 1899
Simpson, William G	June 12th, 1899
Hargreaves, James	February 5th, 1901
Drinnan, Robert G	February 5th, 1901
Stockett, Thomas, Jr	August 3rd, 1901
Cunliffe, John	August 3rd, 1901
Evans, Daniel	August 3rd, 1901
Browitt, Benjamin	Aug. 3rd, 1901
McEvoy, James	October 17th, 1902
Wilson, A. R	October 17th, 1902
Simister, Charles	October 17th, 1902
Budge, Thomas	October 17th, 1902
Mills, Thomas	October 17th, 1902
Faulds, Alexander	October 17th, 1902
Richards, James A	October 17th, 1902
McLean, Donald	January 21st, 1904
Wilkinson, Geo	January 21st, 1904
Wright, H. B	January 21st, 1904
Coulthard, R. W	January 21st, 1904
Roaf, J. Richardson	January 21st, 1904
John, John	January 21st, 1904
Manley, H. L	January 21st, 1904
Baxter, Andrew	June 10th, 1911
Battey, Richard	May 27th, 1913
Newbury, Arthur	June 21st, 1920

First-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904."

Name.	Date.	Name.	Date.
Biggs, J. G	July 22, 1908	Davies, Stephen	Nov. 15, 1917
Bonar, Robert	Oct. 28, 1911	Davies, Thos. Owen	May 21, 1914
Brace, Tom	May 13, 1915	de Hart, J. B	May 17, 1917
Bridge, Edward	July 22, 1908	Derbyshire, James	Nov. 9, 1907
Brown, David	May 21, 1914	Devlin, Henry	May 1, 1909
Brown, Robert Joyce	May 13, 1915	Dickson, James	Oct. 31, 1912
Caufield, Bernard	May 1, 1909	Elliott, Daniel	Nov. 9, 1907
Church, James A. H	June 10, 1911	Emmerson, Joseph	Nov. 9, 1907
Cox, Richard	May 13, 1915	Fairfoull, Robert	June 10, 1911
Crowder, James	June 10, 1911	France, Thos	Nov. 22, 1906
Cunningham, John Howard	May 9, 1912	Fraser, Norman	Mar. 4, 1905
Davidson, W. A	May 1, 1909	Freeman, H. N	May 1, 1909
Davies, David	June 10, 1911	Galloway, C. F. J	July 22, 1908

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	NAME.	DATE.
Garman, Morris W	Nov. 15, 1917	O'Brien, George	May 21, 1914
Gascoyne, Rowland B	May 21, 1914	Ovington, John	May 27, 1913
Glover, Francis	Oct. 31, 1912	Peacock, Frank David	Oct. 28, 1911
Graham, Charles	Nov. 14, 1905	Penman, Hugh	May 21, 1914
Graham, Thomas	Nov. 9, 1907	Phelan, Arthur	May 27, 1913
Gray, James	Nov. 27, 1909	Powell, J. W	June 10, 1911
Henderson, Robert	Nov. 27, 1909	Quinn, John Graham	July 8, 1916
Hewlett, Howe	May 27, 1913	Ramsay, Peter Millar	May 16, 1918
Higgins, Alexander	Dec. 19, 1918	Roper, William	May 13, 1915
Holden, James	May 1, 1909	Russell, John	May 21, 1914
Howden, Archibald	May 27, 1913	Scott, Thomas Wright	Dec. 22, 1921
Howells, Nathaniel	Oct. 28, 1911	Shanks, John	May 1, 1909
Hughes, John C	May 17, 1917	Shaw, William	May 9, 1912
Humphries, Clifford	June 10, 1911	Shenton, T. J	Sept 10, 1910
Hunter, Alex. B	July 8, 1916	Shone, Samuel	May 1, 1909
Jackson, Thos. R	Nov. 9, 1907	Smith, A. E	Oct. 28, 1911
James, William	July 22, 1908	Smith, Joseph	July 22, 1908
Jaynes, Frank	May 13, 1915	Smith, Thos. Edwin	Dec. 19, 1918
Jemson, Jas. W	May 27, 1913	Spicer, J. E	Oct. 28, 1911
Kellock, George	June 10, 1911	Spruston, T. A	Nov. 27, 1909
Knox, T. K	July 27, 1909	Stevens, L. C	Nov. 27, 1909
Laird, Robert	Nov. 15, 1917	Stewart, R. T	Sept. 10, 1910
Leighton, Henry	May 9, 1912	Strachan, Robert	Mar. 4, 1905
Macauley, D. A	June 10, 1911	Strang, James	June 10, 1911
McCulloch, James	Sept. 10, 1910	Taylor, James	May 16, 1918
McDonald, John	Oct. 3, 1919	Thomas, J. D	Sept. 10, 1910
McGuckie, Thomas	July 22, 1908	Thorne, B. L	Sept. 10, 1910
McKendrick, Andrew	May 27, 1913	Touhey, James	May 21, 1914
McMillan, J. H	Sept. 10, 1910	Walker, William	May 16, 1918
McVicar, Samuel	May 1, 1909	Wallbank, J	Sept. 10, 1910
Mazey, William John	Oct. 31, 1912	Warburton, Ernest Leonard	July 8, 1916
Miard, Henry Ernest	May 9, 1912	Wark, Samuel David	Oct. 3, 1919
Michell, Dudley	Nov. 15, 1917	Wesnedge, William	Dec. 19, 1918
Millar, John K	Nov. 22, 1906	Whittaker, John	Dec. 19, 1918
Miller, Andrew Anderson	Oct. 31, 1912	Williams, John Samuel	Dec. 19, 1918
Montgomery, John W	May 1, 1909	Williams, Thos. B	May 17, 1917
Moore, Wm. H	May 17, 1917	Williams, Thos. H	Nov. 22, 1906
Mordy, Thomas	Sept. 10, 1910	Wilson, Ridgeway R	Nov. 15, 1917
Mottishaw, Sam. K	Nov. 15, 1917	Wilson, William	May 16, 1918
Murray, George	June 21, 1921	Wylie, John	July 22, 1908

SECOND-CLASS CERTIFICATES OF SERVICE.

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Lee, John S	March 4, 1905	B 9	Hunt, John	March 4, 1905	B 13
Millar, J. K	March 4, 1905	B 10	Walker, David	March 4, 1905	B 14
McCliment, John	March 4, 1905	B 11	Powell, William Baden	March 4, 1905	B 16
Martin, David	March 4, 1905	B 12	Bryden, Alexander	March 4, 1905	B 18

Second-class Certificates of Competency issued under "Coal-mines Regulation Act Further Amendment Act, 1904."

Name.	Date.	Cer. No.	Name.	Date.	Cer. No.
Adamson, Robert	Sept. 10, 1910	B 120	Garbett, Richard	Oct. 31, 1912	B 161
Allan, Alex. McDairmid	May 27, 1913	B 167	Garman, Morris Wilbur	Oct. 31, 1912	B 155
Almond, Walter	Nov. 15, 1917	B 213	Gilham, John	June 21, 1920	B 237
Ball, Benjamin	June 21, 1920	B 235	Gillespie, Hugh	July 29, 1905	B 24
Barclay, Andrew	July 29, 1905	B 25	Gillespie, John	Oct. 23, 1906	B 36
Barlow, Benjamin Robert	Dec. 19, 1918	B 229	Gould, Alfred	May 13, 1915	B 190
Baybutt, Thomas	July 8, 1916	B 206	Gourlay, Robert	Dec. 19, 1918	B 227
Bell, John	May 17, 1917	B 212	Graham, Chas	Mar. 4, 1905	B 1
Beveridge, William	June 21, 1920	B 233	Gray, David	May 1, 1909	B 76
Bevis, Nathaniel	Sept. 10, 1910	B 123	Gray, George	July 8, 1916	B 207
Biggs, John	May 1, 1909	B 94	Greenwell, Archibald	May 16, 1918	B 220
Biggs, John G	Nov. 2, 1907	B 40	Hamilton, Robert N	May 21, 1914	B 175
Blair, James	May 13, 1915	B 197	Hastings, Andrew Peacock	Dec. 19, 1918	B 223
Brace, Tom	Nov. 27, 1909	B 96	Henderson, Robert	July 22, 1908	B 60
Bridge, Edward	Oct. 23, 1906	B 33	Holliday, William	Dec. 19, 1918	B 230
Brown, David	Sept. 10, 1910	B 108	Horrocks, Abner G	June 10, 1911	B 130
Brown, George	Dec. 19, 1918	B 225	Howells, Nathaniel	Nov. 27, 1909	B 97
Brown, James L	Oct. 28, 1911	B 136	Huby, Norman W	May 13, 1915	B 198
Brown, John C	Oct. 23, 1906	B 39	Hudson, George	Sept. 10, 1910	B 121
Brown, John Todd	May 9, 1912	B 150	Hughes, John C	Sept. 10, 1910	B 109
Brown, R. J	Oct. 28, 1911	B 134	Hutton, Isaac	May 21, 1914	B 185
Brown, Robert	May 21, 1914	B 183	Hutton, John	May 9, 1912	B 154
Brown, Robert Sneddon	May 13, 1915	B 196	Hynds, William	Dec. 14, 1920	B 240
Brown, William Gold	Dec. 19, 1918	B 228	Jackson, Thos. R	Mar. 4, 1905	B 5
Brownrigg, John H	May 17, 1917	B 124	James, David	Nov. 2, 1907	B 58
Bushell, J. P	May 1, 1909	B 81	Jarrett, Fred	May 1, 1909	B 84
Carroll, Henry	July 22, 1908	B 62	Jaynes, Frank	Sept. 10, 1910	B 111
Caufield, Bernard	Oct. 23, 1906	B 30	John, Francis	July 8, 1916	B 200
Caufield, John	July 8, 1916	B 199	John, Howell	Sept. 10, 1910	B 122
Cawthorne, L	May 1, 1909	B 93	Johnson, Moses	May 1, 1909	B 75
Challinor, Jno. Thomas	May 27, 1913	B 169	Jones, Samuel	May 16, 1918	B 221
Challoner, Jno. Arthur	May 21, 1914	B 178	Jones, William T	July 22, 1908	B 66
Churchill, James	July 22, 1908	B 65	Jordon, Thos	Nov. 27, 1909	B 104
Clark, Robt	June 21, 1921	B 242	Joyce, Walter	May 27, 1913	B 168
Clarkstone, Wm. W	May 21, 1914	B 180	Kirkwood, John Robertson	Oct. 31, 1912	B 160
Commons, Wm.	Sept. 10, 1910	B 115	Knowles, James E	Oct. 28, 1911	B 137
Coupland, George	May 16, 1918	B 217	Laird Robert	May 17, 1917	B 210
Courtney, A. W	Oct. 28, 1911	B 138	Lander, Frank	May 13, 1915	B 195
Cox, Richard	May 9, 1912	B 143	Lane, Joseph	May 9, 1912	B 142
Crawford, David	May 1, 1909	B 88	Lee, Robert John	Sept. 10, 1910	B 110
Cunliffe, Thomas	May 1, 1909	B 78	Littler, Matthew	Oct. 31, 1912	B 157
Dando, John	May 27, 1913	B 164	Luck, George	June 10, 1911	B 128
Daniels, David	Nov. 2, 1907	B 53	Manifold, Albert	May 9, 1912	B 145
Derbyshire, James	Oct. 23, 1906	B 32	Marsh, John	Nov. 15, 1917	B 216
Davidson, Hugh	May 27, 1913	B 165	Mason, Joseph	May 13, 1915	B 193
Davies, Stephen	Sept 10, 1910	B 113	Massey, H	Nov. 27, 1909	B 99
Dennis, Fred. W	May 21, 1914	B 174	Mather, Thomas	June 10, 1911	B 127
Devlin, Ernest H	May 21, 1914	B 179	Matusky, A	May 1, 1909	B 91
Devlin, Henry	Nov. 2, 1907	B 44	Mayer, Ralph Waldo	May 9, 1912	B 144
Dewar, Alexander	Oct. 31, 1912	B 162	Mazay, W. J	Nov. 27, 1909	B 101
Dickenson, Clifford	May 13, 1915	B 189	Menzies, Fred	Dec. 22, 1921	B 244
Dunsmuir, John	Nov. 14, 1905	B 26	Merryfield, William	July 22, 1908	B 61
Dykes, J. W	May 1, 1909	B 77	Miard, Hy. E	Sept. 10, 1910	B 107
Eccleston, Wm	May 1, 1909	B 87	Michek, John	May 17, 1917	B 188
Fairfoull, James	May 21, 1914	B 186	Michell, Dudley	May 13, 1915	B 187
Fairfoull, R	May 1, 1909	B 83	Middleton, Robert	July 22, 1908	B 72
Finlayson, James	July 29, 1905	B 21	Mitchell, Henry	July 8, 1916	B 201
Ford, Allan	May 27, 1913	B 171	Monks, James	Nov. 2, 1907	B 55
Foster, W. R	Nov. 27, 1909	B 102	Moore, Wm. H	May 21, 1914	B 173
France, Thos	May 14, 1905	B 27	Morgan, John	Nov. 2, 1907	B 43
Francis, David M	May 21, 1914	B 182	Morgan, William	Dec. 19, 1918	B 224
Francis, Enoch	May 1, 1909	B 86	Morris, John	July 22, 1908	B 67
Francis, James	July 22, 1908	B 63	Morton, Robert W	July 22, 1908	B 59
Frater, George	July 8, 1916	B 204	Mottishaw, S. K	Oct. 28, 1911	B 135
Freeman, Henry N	Nov. 2, 1907	B 45	Murray, George	Oct. 3, 1919	B 232

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Musgrave, J	May 1, 1909	B 90	Rutherford, Jasper	May 16, 1918	B 219
Myers, Peter	May 9, 1912	B 149	Scarpino, Francis	Dec. 19, 1918	B 226
MacKinnon, Hugh G	Dec. 22, 1921	B 243	Scott, Thomas Wright	June 21, 1921	B 241
McLaughlin, Alex	May 13, 1915	B 191	Shanks, David	Oct. 31, 1912	B 159
McDonald, J.A	Oct. 28, 1911	B 133	Shaw, Thomas John	May 27, 1913	B 166
McDonald, John	May 27, 1913	B 172	Smith, John	Oct. 3, 1919	B 231
McFegan, W	Nov. 31, 1909	B 106	Somerville, Alex	Mar. 4, 1905	B 4
McGarry, Martin	Oct. 31, 1912	B 156	Spruston, Robert Lecce	July 8, 1916	B 202
McGuckie, Thomas M	Oct. 23, 1906	B 35	Spruston, Thos. A	Nov. 2, 1907	B 46
McKelvie, J	May 1, 1909	B 92	Stafford, Matthew	June 10, 1911	B 131
McKendrick, And	Sept. 10, 1910	B 112	Stewart, J. M	May 1, 1909	B 95
McLean, Michael D.	June 21, 1920	B 234	Stobbart, Jacob	May 9, 1912	B 153
McMillan, D	June 10, 1911	B 125	Stockwell, William	Nov. 2, 1907	B 56
McNay, Carmichael	May 9, 1912	B 151	Strang, Thomas	Oct. 31, 1912	B 158
McPherson, James E	July 22, 1908	B 73	Sutherland, John	May 16, 1918	B 218
Neen, Joseph	June 10, 1911	B 129	Taylor, James	May 13, 1915	B 194
Newbury, Arthur	May 21, 1914	B 184	Taylor, Thomas	July 8, 1916	B 203
Newton, Wm	Sept. 10, 1910	B 116	Thomas, J. B	Nov. 27, 1909	B 105
O'Brien, Charles	May 9, 1912	B 148	Thomas, Joseph D	Oct. 23, 1906	B 38
O'Brien, George	May 1, 1909	B 82	Thompson, Joseph	Sept. 10, 1910	B 114
Osborne, Hugh	Dec. 14, 1920	B 239	Touhey, James	May 9, 1912	B 147
Ovington, John	Nov. 2, 1907	B 52	Touhey, William	July 8, 1916	B 205
Park, William	June 21, 1920	B 238	Tonge, Thomas	July 22, 1908	B 71
Parkinson, T	May 1, 1909	B 80	Tully, Thomas	Nov. 15, 1917	B 214
Parnham, Charles	Nov. 2, 1907	B 49	Vanhulle, Peter	Nov. 2, 1907	B 54
Quinn, James	May 21, 1914	B 181	Virgo, John	May 1, 1909	B 89
Quinn, John	May 9, 1912	B 146	Walker, William	May 13, 1915	B 192
Ramsay, Peter Millar	May 17, 1917	B 209	Warburton, Ernest L	May 27, 1913	B 170
Rankin, Geo	Nov. 27, 1909	B 103	Watson, Adam G	Nov. 14, 1905	B 28
Raynes, M. T	Oct. 28, 1911	B 139	Watson, Arthur W	May 17, 1917	B 211
Reid, Wm	Oct. 28, 1911	B 132	Webber, John Frank	Mar. 4, 1905	B 3
Renny, James	Oct. 28, 1911	B 140	Wesnedge, William	Nov. 27, 1909	B 98
Richards, Thomas	Nov. 2, 1907	B 57	White, John	Nov. 2, 1907	B 48
Richards, Samuel	May 9, 1912	B 152	Whitehouse, William	Oct. 31, 1912	B 163
Rigby, John	July 29, 1905	B 29	Williams, John Samuel	Nov. 15, 1917	B 215
Roberts, Ebenezer	Sept. 10, 1910	B 117	Williams, Watkin	Sept. 10, 1910	B 118
Robinson, William	July 22, 1908	B 69	Wilson, Robinson	May 21, 1914	B 177
Rogers, George	May 1, 1909	B 79	Wilson, Thomas	July 22, 1908	B 74
Roper, William	May 9, 1912	B 141	Wilson, William	July 22, 1908	B 70
Rowbottom Thomas	May 16, 1918	B 222	Wood, Thos. James	May 21, 1914	B 176
Russell, John	Nov. 2, 1907	B 47	Worthington, Joseph	May 1, 1909	B 85

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Adamson, Robert	May 1, 1909	C 323	Ball, Alfred	May 17, 1917	C 635
Adamson, Wm	Dec. 22, 1921	C 721	Bann, Thomas	Oct. 31, 1912	C 494
Ainsworth, Edward	May 16, 1918	C 674	Baggaley, J	July 22, 1908	C 300
Allan, Alexander	Oct. 28, 1911	C 430	Bain, James	May 27, 1913	C 546
Almond, Alex	Oct. 1, 1907	C 252	Ball, Benjamin	May 21, 1914	C 583
Almond, Walter	July 22, 1908	C 286	Barker, Robert	June 10, 1911	C 415
Alstead, Robt	June 21, 1921	C 719	Barlow, B. R	May 1, 1909	C 337
Anderson, John	Oct. 28, 1911	C 437	Bateman, Joseph William	Oct. 28, 1913	C 551
Anderson, Peter Blane	Nov. 15, 1917	C 660	Bauld, Wm	June 10, 1911	C 422
Anderson, Robt	Oct. 14, 1914	C 599	Baxter, Robert	Oct 28, 1911	C 450
Angell, William	May 21, 1914	C 591	Baybutt, Thomas	May 27, 1913	C 548
Arbuckle, John	May 13, 1915	C 622	Beeton, D. H	May 1, 1909	C 338
Archibald, Geo	May 21, 1914	C 569	Bell, Fred	May 27, 1913	C 514
Archibald, Thomas	Oct. 28, 1911	C 454	Bell, John	May 9, 1912	C 477

Third-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—*Continued.*

Name.	Date.	Cer. No.	Name.	Date.	Cer. No.
Bennett, Andrew M.	Nov. 15, 1917	C 661	Coulthard, James	June 10, 1911	C 407
Bennett, John	Oct. 14, 1914	C 597	Crawford, David	Mar. 4, 1905	C 208
Bennie, John	June 10, 1911	C 411	Cunningham, G. F.	Nov. 11, 1905	C 229
Beveridge, Wm.	June 10, 1911	C 396	Cunliffe, Thos	Oct. 1, 1907	C 265
Biggs, John	Mar. 4, 1905	C 210	Dabb, Owen	May 21, 1914	C 578
Biggs, Thomas	Oct. 28, 1911	C 449	Dando, John	May 9, 1912	C 465
Birchell, Richard	Oct. 1, 1907	C 266	Davey, George	June 21, 1921	C 718
Blair, James	Oct. 31, 1912	C 502	Davidson, Hugh	May 9, 1919	C 464
Blewett, Ernest	July 22, 1908	C 298	Davies, Alfred	Oct. 3, 1912	C 691
Blinkhorn, Thomas	Dec. 19, 1918	C 681	Davies, Evan Thomas	May 9, 1912	C 463
Bradley, William	July 22, 1908	C 291	Davis, John David	May 16, 1918	C 669
Bridge, Edward	July 29, 1905	C 223	Davis, William	May 1, 1909	C 339
Briscoe, F.	July 22, 1908	C 309	Dean, Andrew	Dec. 19, 1918	C 688
Broderick, Matthew	Jan. 21, 1913	C 525	Dean, Joseph	May 13, 1915	C 611
Brown, Arthur A.	Oct. 14, 1914	C 596	Derbyshire, A.	June 10, 1911	C 401
Brown, David	Nov. 1, 1909	C 348	Dewar, Alex.	Sept. 10, 1910	C 369
Brown, George	July 8, 1916	C 626	Devlin, Edward	Oct. 23, 1906	C 241
Brown, George A.	Dec. 14, 1920	C 706	Devlin, Ernest Henry	May 27, 1913	C 538
Brown, James	Sept. 10, 1910	C 364	Devlin, John	Oct. 3, 1919	C 693
Brown, James	June 10, 1911	C 412	Devoy, William	May 17, 1917	C 638
Brown, James	July 8, 1916	C 625	Dickenson, Clifford	May 27, 1917	C 532
Brown, Jas. Millie	May 13, 1915	C 615	Dingsdale, Geo.	Oct. 28, 1911	C 459
Brown, John	Sept. 10, 1910	C 392	Dobie, Thomas	Dec. 22, 1921	C 726
Brown, Robert	Oct. 28, 1911	C 451	Doherty, J. J.	May 1, 1909	C 340
Brown, Robert D.	June 10, 1911	C 423	Doney, John	Mar. 4, 1905	C 211
Brown, Robert S.	June 10, 1911	C 408	Donnachie, John	June 10, 1911	C 425
Brown, Wm. A.	May 21, 1914	C 576	Doodson, Robert	Oct. 28, 1911	C 455
Brown, William Gold	July 8, 1916	C 629	Dorrance, Orlin William	Jan. 21, 1913	C 517
Bruce, Preston	Dec. 14, 1920	C 712	Douglas, D. B.	Oct. 23, 1906	C 235
Bullen, Thomas	Sept. 10, 1910	C 379	Dow, And. Y.	May 21, 1914	C 587
Bushell, Jas. P.	Oct. 1, 1907	C 264	Drybrough, Robert	June 21, 1920	C 701
Bysouth, Thomas	May 16, 1918	C 673	Dunn, Wm.	Oct. 14, 1914	C 606
Cairns, Andrew	June 10, 1911	C 420	Dunnigan, Richard	June 21, 1921	C 716
Cairns, Robert	May 27, 1913	C 539	Dykes, Isaac	June 10, 1911	C 409
Caldwell, Daniel	May 17, 1917	C 639	Dykes, Joseph W.	Oct. 1, 1907	C 248
Caldwell, Peter	June 21, 1921	C 715	Eccleston, Thomas	May 17, 1917	C 482
Calverly, Joseph	Sept. 10, 1910	C 375	Edwards, John	May 27, 1913	C 542
Camamile, Hollis	Oct. 28, 1911	C 443	Elliott, John	May 27, 1913	C 541
Campbell, Samuel	Nov. 15, 1917	C 662	Elmes, George	Oct. 31, 1912	C 511
Campbell, Andrew	Nov. 27, 1917	C 651	Evans, D.	July 22, 1908	C 284
Carr, Peter	Oct. 31, 1912	C 497	Ewing, Robert	May 13, 1915	C 608
Carson, George	Mar. 17, 1917	C 663	Fairfoull, James	Oct. 28, 1911	C 453
Catchpole, Charles	July 29, 1905	C 227	Farrow, John William	Dec. 19, 1918	C 683
Caufield, Edward	May 16, 1918	C 670	Ferryman, Henry	June 21, 1920	C 697
Caufield, John	May 1, 1909	C 321	Fitzpatrick, T. J.	Oct. 2, 1911	C 452
Challoner, Arthur	Oct. 28, 1911	C 433	Flockart, David	Jan. 21, 1913	C 531
Chambers, Ralph H.	Dec. 14, 1920	C 709	Ford, Allen	Oct. 28, 1911	C 445
Chapman, Wm.	Dec. 22, 1921	C 720	Fowler, Robert	Oct. 31, 1912	C 495
Charnock, John	Nov. 15, 1917	C 653	Francis, David Morgan	Oct. 28, 1913	C 558
Cheetham, Ben	July 22, 1908	C 311	Francis, James	Oct. 1, 1907	C 250
Chester, John	Oct. 28, 1911	C 440	Frater, George	May 13, 1915	C 616
Clark, Lewis	June 10, 1911	C 405	Freeman, H. N.	Nov. 14, 1905	C 230
Clark, Walter Pattison	May 9, 1912	C 480	Frew, Andrew	Nov. 27, 1909	C 360
Clarkson, Robert	June 21, 1920	C 696	Frodsham, Vincent	July 22, 1908	C 282
Clarkstone, Wm. W.	Oct. 28, 1911	C 431	Furbow, John	Jan. 21, 1913	C 528
Cleaves, Walter	May 9, 1912	C 475	Garbett, Richard	Sept. 10, 1910	C 377
Clifford, William	July 22, 1908	C 313	Gascoyne, Rowland B.	Jan. 21, 1913	C 513
Colgrove, Charles Henry	Dec. 19, 1918	C 679	Geater, Jas. Gordon	May 21, 1914	C 573
Commons, William	July 22, 1908	C 304	Gemmell, James	Oct. 31, 1912	C 505
Coupland, David	June 21, 1921	C 713	Gillham, John	May 13, 1915	C 623
Cooke, Joseph	Mar. 4, 1905	C 209	Gillies, William	May 16, 1918	C 668
Coomb, Alexander	May 27, 1913	C 533	Glenn, James	Oct. 28, 1911	C 435
Cooper, John Andrew	Dec. 19, 1918	C 689	Gordon, Davis John	May 9, 1912	C 474
Cope, Frank	Oct. 28, 1913	C 549	Gourley, Robert	May 9, 1912	C 470

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Gray, George	May 9, 1912	C 467	Lane, Joseph	Oct. 1, 1907	C 254
Green, William	Nov. 15, 1917	C 659	Lavin, Joseph	June 21, 1920	C 700
Greenhorn, John	May 21, 1914	C 575	Leeman, T.	May 1, 1909	C 345
Griffiths, Edward	Oct. 31, 1914	C 508	Lewis, Benj. J.	Sept. 10, 1910	C 386
Gunniss, Matthew	May 9, 1912	C 460	Leynard, Paul	May 17, 1917	C 637
Hallinan, William	May 1, 1909	C 343	Liddle, John	July 29, 1905	C 228
Halsall, J.	July 22, 1908	C 307	Lindsay, William	May 17, 1917	C 642
Hamilton, John	Oct. 28, 1911	C 444	Littler, John	June 10, 1911	C 410
Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550	Littler, Matthew	June 10, 1911	C 417
Hampton, Samuel	Nov. 15, 1917	C 650	Littler, Robert	June 10, 1911	C 418
Hancock, Arthur	Nov. 15, 1917	C 656	Livingstone, Alex.	Oct. 28, 1911	C 436
Hardy, Edward	June 21, 1920	C 694	Loxton, George	June 10, 1911	C 428
Hartley, Thomas	Oct. 31, 1912	C 510	Loxton, John	June 10, 1911	C 416
Harwood, Fred.	Sept. 10, 1910	C 384	Luck, George	May 1, 1909	C 318
Harvey, Thomas	May 9, 1912	C 466	Lynch, Stewart	Oct. 28, 1911	C 432
Harvie, George	Sept. 10, 1910	C 378	Mackie, John.	June 10, 1911	C 421
Heaps, Robert	Sept. 10, 1910	C 373	Makin, J. Wm.	Sept. 10, 1910	C 385
Hemer, Herbert	Oct. 14, 1914	C 595	Malone, John	May 21, 1914	C 585
Henney, Jonathan	June 10, 1911	C 424	Malone, Patrick	Oct. 1, 1907	C 247
Hendry, James	May 9, 1912	C 471	Maltman, James	Oct. 31, 1912	C 501
Herd, William	Dec. 19, 1918	C 682	Mansfield, A.	May 1, 1909	C 336
Heyes, Edward	May 1, 1909	C 320	Marrs, John	May 17, 1917	C 640
Hill, Isaac	Nov. 15, 1917	C 664	Marsh, Daniel Parks	May 27, 1913	C 543
Hilley, Fred	July 22, 1908	C 290	Marsh, John	Oct. 1, 1907	C 270
Hilton, Mathias	Dec. 19, 1918	C 677	Martin, James	June 10, 1911	C 398
Hilton, R. G.	Sept. 10, 1910	C 376	Mason, Joseph	July 22, 1908	C 297
Hodson, R. H.	Mar. 4, 1905	C 216	Massey, Henry	May 1, 1909	C 317
Holdsworth, William	May 16, 1918	C 671	Mather, Thomas	July 22, 1908	C 293
Holliday, William	July 8, 1916	C 634	Matusky, Andrew	Oct. 1, 1907	C 259
Horbury, Joseph W.	June 10, 1911	C 406	Mawson, J. T	Nov. 27, 1909	C 359
Horrocks, A. G.	May 1, 1909	C 324	Maxwell, Geo.	May 21, 1914	C 571
Horwood, S.	July 22, 1908	C 312	McAlpine, John	Mar. 4, 1905	C 217
Houston, Robert	July 8, 1916	C 631	McArthur, John Malcolm	May 17, 1917	C 648
Howells, Nathaniel	May 1, 1909	C 316	McArthur, Robert	Dec. 22, 1921	C 723
Huby, Norman	June 10, 1911	C 394	McBroom, Al.	July 2, 1908	C 287
Hutchison, Ben.	Nov. 14, 1905	C 232	McCourt, John	Oct. 14, 1914	C 605
Hutchison, Fred.	Nov, 27, 1909	C 358	McCulloch, James	May 1, 1909	C 315
Hynd, John	Dec. 14, 1920	C 707	McDonald, John	Oct. 28, 1911	C 448
Hynds, William	July 8, 1916	C 632	McFagen, Alexander	May 9, 1912	C 490
Ireson, John.	Oct. 31, 1912	C 507	McFegan, Robert	June 21, 1920	C 698
Irvine, David	June 10, 1911	C 413	McFegan, W.	May 1, 1909	C 319
Jack, John	May 21, 1914	C 582	McGarry, Martin	May 1, 1909	C 326
James, Thos.	May 21, 1914	C 588	McGrath, James	July 8, 1916	C 630
Jardine, George Edward	Jan. 21, 1913	C 521	McGuckie, Jno. M.	May 21, 1914	C 562
Jarrett, Fred. J.	Oct. 1, 1907	C 256	McGuckie, Thomas	July 29, 1905	C 226
Jaynes, Frank	July 22, 1908	C 277	McGuire, Thomas	Oct. 28, 1913	C 553
Jemison, J. W.	Mar. 4, 1905	C 205	McIntyre, Neil	May 21, 1914	C 574
Jenkins, John	Sept. 10, 1910	C 390	McKelvie, J.	July 22, 1908	C 285
John, Howel	July 22, 1908	C 305	McKenzie, Peter	June 10, 1911	C 427
Johnson, Moses	Oct. 1, 1907	C 258	McKibben, Matthew	May 21, 1914	C 580
Johnston, Robert	May 9, 1912	C 479	McKinley, John	Oct. 28, 1914	C 442
Jones, Alf. Geo.	May 21, 1914	C 584	McLaughlin, James	May 9, 1912	C 485
Jones, Samuel	May 27, 1913	C 518	McLachlan, Alex.	June 10, 1912	C 419
Jones, William C.	Jan. 21, 1913	C 556	McLean, M. D.	Sept. 10, 1910	C 389
Jones, William Ernest	Oct. 28, 1913	C 221	McLellan, William	Mar. 4, 1905	C 219
Jones, W. T.	Mar. 4, 1905	C 544	McLeod, James.	July 22, 1908	C 296
Joyce, Walter	Nov. 27, 1909	C 361	McLeod, John	May 13, 1915	C 609
Judge, Peter	Sept. 10, 1910	C 391	McMeakin, James	May 13, 1915	C 612
Keenan, Wm. James	June 10, 1911	C 426	McMillan, D.	Sept. 10, 1910	C 363
Kelly, Ernest	May 17, 1917	C 646	McMillan, Edward	Oct. 31, 1912	C 493
Kemp, Wm.	Oct. 14, 1914	C 594	McMillan, Neil.	Nov. 15, 1917	C 654
Kingham, Alfred	Oct. 28, 1913	C 559	McNay, Carmichael	July 22, 1908	C 306
Kirkeberg, H. S.	Nov. 27, 1909	C 350	McNeill, Adam L.	July 22, 1908	C 281
Klejko, Steve	Dec. 14, 1920	C 703	McNeill, Robert	Sept. 10, 1910	C 387

Third-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904"—*Continued.*

Name.	Date.	Cer. No.	Name.	Date.	Cer. No.
Meek, Matthew	May 9, 1912	C 484	Reid, Robert	Sept. 10, 1910	C 383
Meikle, Harry Alexander	July 8, 1916	C 627	Reid, Thos.	May 21, 1914	C 592
Menzies, Frederick	Dec. 14, 1920	C 704	Reid, Wm.	June 10, 1911	C 403
Merrifield, George	Oct. 23, 1906	C 239	Reilly, Thomas	July 22, 1908	C 303
Merrifield, William	Oct. 23, 1906	C 236	Renney, Jas.	Nov. 27, 1909	C 354
Michek, John	May 21, 1914	C 563	Richards, James	Nov. 1, 1907	C 249
Miles, John	June 10, 1911	C 414	Richards, Samuel	Oct. 23, 1906	C 244
Mitchell, Charles	May 1, 1909	C 322	Richardson, J. H.	Oct. 28, 1911	C 458
Mitchell, Henry	Sept. 10, 1910	C 366	Rigby, John	July 29, 1905	C 225
Monks, James	Nov. 14, 1905	C 234	Roberts, Ebenezer	May 1, 1909	C 327
Moore, George	Oct. 23, 1906	C 242	Robinson, Michael	May 1, 1909	C 332
Moore, John	May 1, 1909	C 335	Robson, Thomas	May 21, 1914	C 566
Moreland, Thomas	July 22, 1908	C 299	Rogers, Ellis	May 13, 1915	C 624
Morgan, John	July 29, 1905	C 224	Roper, William	July 22, 1908	C 274
Morgan, William	May 17, 1917	C 636	Ross, William	June 21, 1920	C 702
Morgan Cornelius	Dec. 22, 1921	C 725	Rowan, Alexander	Oct. 31, 1912	C 500
Morris, David	May 9, 1912	C 472	Rowan, John	Oct. 14, 1914	C 602
Mottishaw, Samuel K	Oct. 23, 1906	C 237	Rowbottom, Thomas	Oct. 31, 1914	C 492
Murdock, Jno. Y.	May 21, 1914	C 564	Royle, Edward	Oct. 31, 1912	C 506
Myers, Peter	Oct. 28, 1911	C 446	Russell, Robert	Nov. 27, 1909	C 351
Nanson, T. H.	July 22, 1908	C 280	Rutherford, Jasper	May 17, 1917	C 644
Nash, George William	May 17, 1917	C 565	Rutledge, Edwin	July 22, 1908	C 302
Nash, George F.	Dec. 22, 1921	C 727	Scott, Henry	July 22, 1908	C 294
Nee, Wm. R.	Dec. 22, 1921	C 724	Saunders, Eustace L.	Jan. 21, 1913	C 520
Neen, Joseph	Nov. 27, 1909	C 352	Scarpino, Francis	May 17, 1917	C 649
Nelson, Horatio	Oct. 1, 1907	C 263	Seddon, James	Oct. 3, 1919	C 692
Neilson, William	May 9, 1912	C 481	Shanks, David	Sept. 10, 1910	C 372
Newman, John	Oct. 14, 1914	C 603	Sharp, James	May 1, 1909	C 325
Nicholson, James	May 9, 1912	C 469	Sharples, J. T.	Sept. 10, 1910	C 380
Nimmo, James	May 9, 1912	C 461	Shea, Thomas J	Dec. 22, 1921	C 722
Norris, Joshua	Oct. 28, 1913	C 557	Shearer, L	May 1, 1909	C 330
Oakes, Robert	Oct. 31, 1912	C 498	Shields, Thomas	May 16, 1918	C 667
O'Brien, Charles	Nov. 27, 1909	C 349	Shipley, John W.	Oct. 28, 1911	C 456
Odgers, Alfred	Jan. 21, 1913	C 529	Shooter, Joseph	Oct. 1, 1907	C 261
Odgers, Eli	Jan. 21, 1913	C 523	Shortman, J	May 1, 1909	C 331
Orr, Alexander	Oct. 28, 1911	C 434	Simister, J. H.	Nov. 27, 1909	C 353
Osborne, Hugh	Oct. 28, 1913	C 555	Simister, W	May 1, 1909	C 334
Oswald, Geo. L.	Sept. 10, 1910	C 370	Sim, James	Dec. 14, 1920	C 711
Owen, Thomas	May 1, 1909	C 347	Simms, Hubert Allan	Jan. 21, 1913	C 526
Park, William	Dec. 19, 1918	C 684	Sinclair, William	Jan. 21, 1913	C 527
Parks, Alexander	Jan. 21, 1913	C 519	Skelton, Thos	May 1, 1909	C 344
Parker, L.	May 1, 1909	C 341	Smith, A. E.	Sept. 10, 1910	C 367
Parkinson, James William	Nov. 15, 1917	C 655	Smith, John Watterson	May 16, 1918	C 665
Parkinson, T.	July 22, 1908	C 289	Smith, Joseph	Mar. 4, 1905	C 207
Parrott, Jas. E.	May 21, 1914	C 590	Smith, Richard Beveridge	Oct. 28, 1913	C 561
Parson, Herbert	May 13, 1915	C 621	Smith, Thos. J.	Oct. 1, 1907	C 271
Pearson, Jonathan	May 9, 1912	C 473	Smith, Thomas	May 9, 1912	C 486
Penman, Hugh	Oct. 28, 1913	C 552	Smith, Thomas	Dec. 14, 1920	C 705
Perry, George Harewood	May 17, 1917	C 643	Snow, Aubrey	June 15, 1918	C 675
Phillips, Richard Stephen	May 17, 1917	C 620	Sopwith, Reginald Scott	Jan. 21, 1913	C 512
Pickup, A.	July 22, 1908	C 310	* Sparks, Edward	Oct. 1, 1907	C 255
Picton, W.	May 1, 1909	C 333	Spencer, G.	May 1, 1909	C 329
Plank, Samuel	Nov. 14, 1905	C 233	Spruston, R. L.	Nov. 27, 1909	C 355
Poole, Samuel	May 27, 1913	C 536	Spruston, Thomas A.	Mar. 4, 1905	C 206
Price, Walter	Sept. 10, 1910	C 371	Stafford, M.	Sept. 10, 1910	C 382
Puckey, John Thomas	Dec. 19, 1918	C 687	Starr, Wallace	May 9, 1912	C 488
Quinn, James	Oct. 28, 1911	C 441	Staton, Edward	May 21, 1914	C 581
Quinn, John	Oct. 28, 1911	C 429	Steele, Walter	Oct. 28, 1911	C 439
Radford, Albert	May 21, 1914	C 579	Stewart, George	May 27, 1913	C 534
Rallison, R.	July 22, 1908	C 279	Stewart, James M.	Oct. 23, 1906	C 240
Rankin, George	July 22, 1908	C 275	Stockwell, William	Oct. 23, 1906	C 238
Rankin, Wm. Shaw	May 9, 1912	C 489	Stone, Wm. C.	June 21, 1921	C 714
Ratcliffe, Thomas	Oct. 1, 1907	C 253	Strachan, John	Oct. 14, 1914	C 604
Raynor, Fred	Oct. 1, 1907	C 257	Strang, James	May 13, 1915	C 614

* C 314 issued in lieu of C 255 destroyed by Fernie fire.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Strang, Thomas	June 10, 1911	C 400	Warburton, Ernest Leonard	June 10, 1911	C 399
Strang, Wm.	June 10, 1911	C 395	Ward, Ernest Hedley	May 17, 1917	C 641
Sutherland, John	May 27, 1913	C 545	Wardrop, James	Oct. 31, 1912	C 504
Taylor, Charles M.	Mar. 4, 1905	C 213	Watson, Adam G	Mar. 4, 1905	C 212
Taylor, Hugh	Jan. 21, 1913	C 530	Watson, Arthur W.	May 27, 1913	C 535
Taylor, James	May 21, 1914	C 567	Watson, George	July 22, 1908	C 288
Taylor, Jonathan	Dec. 19, 1918	C 680	Watson, Joseph	Jan. 21, 1913	C 515
Taylor, J. T.	Oct. 28, 1911	C 447	Watson, William	Oct. 22, 1906	C 246
Taylor, Leroy	Sept. 10, 1910	C 381	Watson, William	May 17, 1917	C 645
Taylor, Robert	June 21, 1920	C 695	Webb, Herbert	Oct. 28, 1911	C 457
Taylor, Thomas	May 21, 1914	C 577	Webster, James Stewart	Dec. 19, 1918	C 685
Thacker, Geo.	May 27, 1913	C 537	Weeks, John	Mar. 4, 1905	C 214
Thomas, Thomas	Sept. 10, 1910	C 365	West, James Gloag	May 16, 1918	C 676
Thomas, John B.	Nov. 14, 1905	C 231	Whalley, William	Dec. 19, 1918	C 686
Thomas, Joseph.	Mar. 4, 1905	C 220	White James	Oct. 31, 1912	C 499
Thomas, Warriett	Oct. 1, 1907	C 273	White, John	Oct. 22, 1906	C 245
Thomason, Charles	Nov. 15, 1917	C 657	Whitehouse, Wm.	June 10, 1911	C 402
Thompson, Thomas	Oct. 1, 1917	C 267	Wilkinson, Edward	Oct. 28, 1911	C 438
Thompson, John.	Oct. 31, 1912	C 509	Williams, John Sam.	June 10, 1911	C 404
Thompson, Joseph	Oct. 1, 1907	C 269	Williams, Watkin	June 22, 1908	C 301
Thomson, Duncan	Mar. 4, 1905	C 218	Wilson, Robinson	June 10, 1911	C 397
Tolley, John	Dec. 19, 1918	C 678	Wilson, Thomas M.	Oct. 1, 1907	C 272
Touhey, William.	May 27, 1913	C 547	Wilson, William	Oct. 1, 1907	C 262
Travis, Joseph.	June 21, 1920	C 699	Wilson, William.	May 17, 1917	C 674
Tully, Thomas	May 9, 1912	C 468	Winstanley, H.	July 22, 1908	C 283
Tune, Elijah	May 9, 1912	C 476	Wintle, Thomas A.	July 29, 1905	C 222
Turnbull, Matthew.	Oct. 14, 1914	C 598	Witherington, George	Oct. 28, 1913	C 554
Vardy, Robt.	May 21, 1914	C 570	Wood, Thos. James	Oct. 31, 1912	C 491
Vaughan, John Henry.	Oct. 28, 1913	C 560	Worthington, J.	July 22, 1908	C 295
Walker, George	July 8, 1916	C 633	Wright, John.	May 21, 1914	C 593
Walker, Jas. Alexander	Oct. 31, 1912	C 496	Wright, Robert.	May 21, 1914	C 589
Walker, Wm.	May 21, 1914	C 586	Wright, William	Jan. 21, 1913	C 522
Wallace, Fred	Oct. 1, 1907	C 260	Young, Alexander	May 16, 1918	C 666
Walls, John	Dec. 14, 1920	C 710			

COAL-MINE OFFICIALS.

Third-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904," sec. 38, subsec. (2), in exchange for Certificates issued under the "Coal-mines Regulation Act Amendment Act, 1901."

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Adam, Robert	Oct. 12, 1904	C 42	Courtney, A. W.	Nov. 2, 1904	C 45
Addison, Thos.	Dec. 10, 1904	C 52	Crawford, Frank	April 6, 1904	C 7
Aitken, James	Oct. 24, 1904	C 44	Daniels, David	April 27, 1904	C 12
Allsop, Harry	Oct. 11, 1904	C 34	Davidson, David	April 3, 1905	C 106
Ashman, Jabez.	Feb. 5, 1907	C 131	Davidson, John	March 29, 1905	C 87
Auchinvole, Alex	March 29, 1905	C 89	Devlin, Henry	Oct. 12, 1904	C 41
Barclay, Andrew	April 27, 1904	C 19	Dobbie, John.	Nov. 27, 1905	C 126
Barclay, James.	April 27, 1904	C 20	Dudley, James	March 22, 1905	C 114
Barclay, John	April 17, 1905	C 111	Duncan, Thomas.	Aug. 29, 1906	C 128
Bickle, Thos.	Oct. 11, 1904	C 37	Dunlap, Henry	Nov. 21, 1904	C 51
Bowie, James	May 13, 1905	C 116	Dunn, Geo	Dec. 19, 1904	C 56
Briscoe, Edward.	Oct. 10, 1906	C 129	Dunsmuir, John	March 29, 1905	C 90
Campbell, Dan	March 29, 1905	C 93	Eccleston, Wm	March 15, 1905	C 80
Carr, Jos. E.	Oct. 11, 1904	C 36	Fagan, David	April 6, 1905	C 109
Carroll, Harry.	March 29, 1905	C 98	Farquharson, John.	April 27, 1904	C 17
Clarkson, Alexander	April 27, 1904	C 18	Findlayson, James	June 6, 1904	C 25
Collishaw, John	Feb. 7, 1905	C 68	Fulton, Hugh T.	April 3, 1905	C 105
Comb, John	March 23, 1904	C 2	Gibson, Edward	May 30, 1905	C 118
Cosier, Wm	March 29, 1905	C 86	Gilchrist, Wm	March 29, 1905	C 85

COAL-MINE OFFICIALS—*Continued.*

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Gillespie, Hugh	April 6, 1904	C 8	Perrie, James	March 15, 1905	C 81
Gillespie, John	April 6, 1904	C 5	Power, John	Sept. 8, 1920	C 142
Gould, Alfred	April 17, 1906	C 112	Price, Jas	Nov. 8, 1904	C 50
Green, Francis	Oct. 11, 1904	C 38	Rafter, Wm	March 29, 1905	C 95
Handlen, Jas	June 16, 1904	C 122	Reid, James	March 23, 1904	C 1
Harmison, Wm	Feb. 3, 1905	C 65	Richards, Thos	April 27, 1904	C 14
Hescott, John	Jan. 16, 1905	C 62	Ross, John	April 3, 1905	C 101
Hoggan, Wm	June 6, 1911	C 134	Roughead, George	Jan. 30, 1907	C 130
John, David	Nov. 8, 1904	C 49	Ryan, John	Dec. 28, 1904	C 59
John, Evan	July 25, 1916	C 140*	Sanders, John W	April 3, 1905	C 107
Johnson, Geo	May 9, 1904	C 124	Shenton, Thos. J	July 25, 1904	C 30
Johnson, Wm. R	March 1, 1905	C 75	Shepherd, Henry	June 13, 1904	C 26
Jones, Evan	April 30, 1913	C 136	Smith, Geo	March 29, 1905	C 84
Kerr, Wm	March 29, 1905	C 91	Somerville, Alex	March 24, 1904	C 3
Lander, Frank	Jan. 9, 1905	C 61	Stauss, Chas. F	Feb. 9, 1905	C 69
Lanfear, Herbert	Jan. 27, 1905	C 63	Steele, Jas	March 29, 1905	C 92
Lewis, Thos	Oct. 11, 1904	C 35	Steele, John	June 4, 1913	C 4
Malpass, James	Nov. 7, 1904	C 113	Stewart, Duncan H	March 28, 1904	C 137
Marsden, John	May 3, 1904	C 21	Stewart, John	April 3, 1904	C 104
Miard, Harry E	March 3, 1905	C 76	Stewart, Daniel W	May 16, 1904	C 23
Middleton, Robt	Feb. 11, 1905	C 71	Stoddart, Jacob	Feb. 21, 1905	C 73
Miller, Thos. K	Feb. 21, 1905	C 74	Strachan, Robt	April 27, 1904	C 15
McKenzie, John R	Oct. 12, 1904	C 40	Strang, James	April 27, 1904	C 10
McKinnon, Arch'd	April 3, 1905	C 102	Sullivan, John	July 4, 1916	C 139
McMillan, Peter	March 29, 1905	C 94	Summers, Joseph	May 17, 1920	C 141
McMurtrie, John	March 29, 1905	C 96	Thomas, John	March 29, 1905	C 97
Moore, Wm. H	June 17, 1905	C 119	Vass, Robt	Dec. 12, 1904	C 53
Morris, John	Dec. 27, 1904	C 57	Vater, Charles	April 6, 1904	C 66
Myles, Walter	April 3, 1905	C 100	Webber, Chas	Sept. 13, 1904	C 32
Nash, Isaac	June 1, 1904	C 120	Webber, Charles F	Sept. 13, 1904	C 33
Neave, Wm	Oct. 12, 1904	C 43	Whiting, Geo	May 29, 1905	C 117
Nelson, James	April 27, 1904	C 16	Wilson, Austin	Feb. 7, 1905	C 67
Nimmo, Jas. P	April 3, 1905	C 103	Wilson, Thos	April 27, 1904	C 11
Nimmo, Richard E	April 18, 1911	C 133	Woodburn, Moses	March 29, 1905	C 83
O'Brien, Geo	Feb. 6, 1905	C 66	Yarrow, Geo	Nov. 3, 1904	C 46
Pearse, Thomas W. H	April 14, 1916	C 138			

* Issued in lieu of No. C 132, lost.

MINE SURVEYOR CERTIFICATES ISSUED UNDER THE "COAL-MINES REGULATION ACT AMENDMENT ACT, 1919."

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Baile, Wynne Jeffreys	Oct. 3, 1919	16	Reger, Frederick William	Oct. 3, 1919	7
Bowerman, Everard S	Dec. 14, 1920	39	Richards, Charles Clifton	Oct. 3, 1919	19
Boyce, Joseph Patrick	Oct. 3, 1919	5	Richards, James A	Oct. 3, 1919	15
Davis, Gerald D	Oct. 3, 1919	28	Ridley, James	Oct. 3, 1919	18
Daniell, George W. B	Oct. 3, 1919	29	Roaf, Joseph Richardson	Oct. 3, 1919	14
Delaney, James	Oct. 3, 1919	21	Scott, Thomas Wright	Oct. 3, 1919	4
Dickson, James	Oct. 3, 1919	3	Strachan, Robert	June 21, 1920	36
Garman, Maurice Wilbur	Oct. 3, 1919	11	Townsend, Neville F	Nov. 17, 1919	31
Gregory, P. W	Nov. 17, 1919	32	Vallance, William Dixon	Oct. 3, 1919	8
Hargreaves, James	Nov. 29, 1920	33	Verkirk, Lucas	June 21, 1921	42
Hepburn, James T	Dec. 14, 1920	37	Waddington, George W	June 21, 1920	35
Holdsworth, William	Oct. 3, 1919	9	Wark, Samuel David	Oct. 3, 1919	20
Hughes, Edward	Dec. 14, 1920	38	White, Harold	Oct. 3, 1919	25
Hunter, George	Oct. 3, 1919	30	Wilson, R. Robinson	Oct. 3, 1919	12
King, Alfred George	Oct. 3, 1919	27	Wilson, Arthur Rupert	Oct. 3, 1919	13
Lancaster, Peter	Oct. 3, 1919	23	Wilson, Charles James	Oct. 3, 1919	22
Lindoe, Luke	June 21, 1921	41	Wilson, Hartley Paul	Oct. 3, 1919	24
Lynn, Albert Crompton	Oct. 3, 1919	17	Wilkie, Octavius B N	Oct. 3, 1919	26
Miard, Harry Ernest	Oct. 3, 1919	2	Wilkinson, George	Oct. 3, 1919	1
McCulloch, Robert	Oct. 3, 1919	6	Wright, Austin	Dec. 14, 1920	40
Owen, William Arthur	Oct. 3, 1919	10			

INSPECTION OF METALLIFEROUS MINES.

KOOTENAY AND BOUNDARY DISTRICTS.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the Kootenay and Boundary Districts for the year 1921.

For the purpose of inspection the district is divided into two, the East Kootenay portion being directly in charge of John MacDonald, Inspector of Mines, Fernie, while the West Kootenay and Boundary is in charge of H. H. Johnstone, Temporary Inspector of Mines, Rossland.

During the year mining operations have been very quiet, especially in the West Kootenay and Boundary District, many of the mines restricting their operations and some closed down temporarily.

The *Emma* mine at Coltern was shut down in June, the ore-body having become exhausted, and the plant was dismantled.

In the Nelson District the *Eureka*, *Mountain Chief*, and the *Yankee Girl*, all of which were working during 1920, remained idle during the year.

The *California* closed down early in the year, while the *Molly Gibson*, which had been closed down, was reopened in November under lease.

The *Granite-Poorman*, after being closed down for a long time, was also reopened in June and worked steadily until the end of the year.

In the Ymir District the *Nuggct* mine worked during the entire year, while the *Queen* was operated for a brief period.

In the Trail District the *Le Roi* and *Centre Star* mines operated during the whole year, while the *Velvet-Portland* was in operation until November.

A force of men was employed around the *Le Roi No. 2*, engaged in reorganizing the mill, and some ore from the dump was treated.

In the Slocan District conditions were very quiet, the *Slocan Star* closing down in March, pending a reorganization of the *Ivanhoe* mill which they had acquired, and it was November before mining was resumed.

The *Rambler-Cariboo* worked intermittently during the year with a small force, while the *McAllister*, *Standard*, *Noble Five*, *Van Roi*, and the *Queen Bess* all worked during some portion of the year.

The *Bosun* operated during the entire year with an average force of twenty-one men, and no work was carried out at either the *Sovereign*, *Wonderful*, *Meteor*, *Ivanhoe*, *Hewitt*, or the *Ottawa*.

In the Ainsworth District the *Blue Bell*, *Silver Bell*, *Silver Bear*, *Carey*, *No. 1 Ainsworth*, *Highland*, and *Whitewater* operated during some portion of the year, while the *Beatrice* and *Index* did not do any mining.

The *Utica* at Kaslo was reopened in October with a force of sixteen men.

In the Boundary District the *Bell* and *Sally* mines at *Beaverdell* worked steadily during the year, and the *Providence* mine at Greenwood closed down in August, with a watchman in charge to attend to the pumps.

The *Rock Candy* mine at Grand Forks did not operate during the year, and, as I have already mentioned, the *Emma* mine was abandoned.

In the East Kootenay District the *Sullivan* mine worked very steadily during the year, both in the upper workings and in the lower. The development-work here is still being energetically pushed, and the indications are that the present output of 950 tons a day will be largely increased in the near future. At the end of the year the work of clearing the ground for a concentrator was commenced, and plans are ready for enlarging the first 400 feet of the tunnel to allow of the using larger mine-cars. In the mine some large stopes have been opened up, and owing to the flatness of the ore-body large scrapers are in use for mucking. These large scrapers are operated by compressed hoists, and electric search-lights of 500-candle power are fitted on stands with swivel joints for illuminating these large stopes.

A few men were employed during the year turning over the old dump at the *North Star* mine, and the *St. Eugene* was closed down early in the year.

The following table shows the number of men employed in the mines inspected during the year as compared with the previous year, according to district:—

	1920.	1921.
Nelson	141	43
Trail	325	224
Slocan	349	101
Ainsworth	119	54
Boundary	145	62
Revelstoke	20	...
East Kootenay	250	220
Totals	1,349	706

This shows a reduction of about 47.6 per cent. in the number of workmen engaged in and around the mines.

In addition to those inspected, there are a number where a few workmen have obtained a lease, and, as I have mentioned in previous reports, it is very difficult to keep trace of these owing in a great measure to no reports being sent to this office of either the temporary abandonment or reopening.

Owing to the above curtailing of operations only twenty-four mines were inspected, as compared with forty-two during the previous year. Of this number, only nine mines had a working staff of over twelve men and fifteen had less than twelve men employed.

One hundred and twenty-four visits of inspection were made during the year; in the case of the larger mines this was made almost monthly, and in the case of the others as occasion warranted.

The general conditions with respect to the enforcement of the "Metalliferous Mines Inspection Act" were fairly good in the case of the larger mines; in some of the smaller properties complaints have had to be made with respect to ladder-ways and explosives. In some of the latter class of mines the method of handling and storing the explosives taken in for the use of the working shift is far from satisfactory or safe. Proper receptacles or storage-places should be provided for the storage of explosives when taken underground and not immediately used, while the explosive should only be issued by or under the supervision of some competent person appointed for the purpose. In some of the smaller mines more attention should be paid to the installing of the ladder-ways, more especially in inclined shafts, that substantial platforms be provided at intervals of not more than 20 feet. These ladders are generally put in temporarily or as a matter of prospecting, and when the shaft later develops great reluctance is shown to have these ladders made to comply with section 31, Rule 21. Under the conditions, I feel it would be better to have them built in as provided by the Act in the first case.

Apart from the foregoing, the general conditions in and around the mines are very good, and especially in the larger mines the managers are to be complimented on their efforts to enforce the provisions of the Act.

The conditions around the cook and bunk houses are very good, and in this respect I should mention that the cook and bunk house at the *Sullivan* mine was destroyed by fire during the year, causing a great deal of inconvenience. The new arrangements provide for twelve bunk-houses, each to contain a limited number of men, two to each room, and a large cook-house. Three of these bunk-houses are already in use, with a temporary cook-house, and all the buildings are to be heated by a common steam plant.

Accidents.

Seven accidents have been reported during the year, six from the East Kootenay District and one from the West Kootenay. The seven accidents resulted in the death of one man and serious injury to six. Haulage caused four accidents, machinery one, cave of roof one (fatal), and miscellaneous one. According to occupation, three miners were injured (including the fatal accident), one mucker, one axeman, one machinist, and one motorman. Six of the accidents occurred inside the mine and one outside.

In the case of the fatal accident, which occurred at the *Rambler-Cariboo* mine, the workman had been sent into an old stope which, after the ore had been extracted, had been filled up with mill-feed ore. No inspection of the stope had been made from the previous day, and when the foreman visited the stope about noon he found the workman dead under a cave of roof-rock.

When I visited the place a few days after the accident I found about 150 square feet of the hanging-wall or roof without any support and full of breaks or fractures, due no doubt to settlement after the ore had been extracted. I feel that more care should be taken to see that the working-place is secure, and while a certain amount of this care may fall on the miner, twenty-four hours is too long a time to elapse between inspections; that is, if these inspections are to count for anything.

In stopes where the mineral has been extracted and are being used for storage or travelling, more and better inspections should be made, and, if possible, some method of systematic timbering either could or should be adopted. In this case the Coroner decided that no inquest was necessary.

The other accidents, all of which occurred in the *Sullivan* mine, four were due to haulage, and I am glad to report that greater care is being taken in this direction.

Twelve samples of mine-air were taken during the year and sent to the Department of Mines at Ottawa to be analysed, and the results showed the conditions to be fairly good. In those taken at the *Sullivan* mine, Kimberley, a very small percentage, not more than 0.04, of carbon monoxide was noted, and is probably due to the practice of bulldozing, breaking-up of large rocks by placing untamped charges of explosives on them.

It is very disappointing to note the lack of interest in the work of first aid to the injured and mine-rescue. In the case of the latter, mine-rescue apparatus have been installed at both the *Sullivan* and *Rossland* mines, but the condition in which they are kept, and the lack of properly trained men to use them, make them more dangerous than useful.

No classes in first aid to the injured have been held during the year at any of the mines, and I feel it would be profitable both to the workmen and the employers to make a greater effort to maintain interest in this humanitarian work.

We wish to thank the officials and workmen for their assistance in discharging our duties during the year.

There have been no prosecutions during the year, and following is a list of the accidents reported during the year:—

LIST OF ACCIDENTS IN METALLIFEROUS MINES, KOOTENAY-BOUNDARY DISTRICT, DURING 1921.

No.	Mines.	Date.	Name.	Occupation.	Details.
1	Sullivan ..... (C.M. & S. Co. of C.)	Dec. 12	A. Bortolozzi.....	Miner	Passing loaded car, when it dumped over on top of him, breaking his arm (occurred in 1920, not reported till March, 1921).
2	Sullivan ..... (C.M. & S. Co. of C.)	Jan. 4	Sid Mayne.....	Axeman	Power-driven saw struck knot, deflecting it so that it struck the hand, severing thumb.
3	Sullivan .... (C.M. & S. Co. of C.)	April 27	Von Battista	Miner	Passenger-locomotive bumped into stalled train, causing party to fall off, his foot getting caught under train, probably fracturing it.
4	Sullivan ..... (C M. & S. Co. of C.)	June 13	Gus Nelson.....	Machinist..	Fractured leg, caused by empty car of a trip jumping off track.
5	Sullivan ... . (C.M. & S. Co. of C.)	" 25	Ar. Shuauh	Motorman...	Severely injured, due to locomotive colliding with another locomotive.
6	Rambler-Cariboo .. (R.C. Mining Co.)	July 24	Geo. Heatherton...	Miner	Cave of rock in stope; fatal.
7	Sullivan ..... (C. M. & S. Co. of C.)	Oct. 18	Philip McNeill	Mucker.....	Piece of rock rolled down from top of muck-pile, fracturing thigh-bone.

NICOLA-PRINCETON INSPECTION DISTRICT.

Report by John G. Biggs, Inspector.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the Nicola-Princeton District for the year ending 1921.

Mining has not been at all active, with most of the larger mining companies suspending operations during the latter part of the year 1920 owing to the cost of production and the unsatisfactory conditions of the markets, and while it must be admitted that there has been a large decrease in the production costs during the year, the markets for the products have remained very sluggish, with the eventual result that the different mining companies have not felt justified in operating.

There was only one mine in this district operated during the whole of the year, which was the *Horn Silver* mine in the Osoyoos District, which employed an average of sixteen men.

The Hedley Gold Mining Company commenced operations at the *Nickel Plate* mine, situated at Hedley, in May, work being only of an exploratory nature; all ore produced was stored in bins, the mill not operating during the year.

The Kamloops Copper Company, while not operating the *Iron Mask* mine during the year, has employed a stall of men in the installation and equipment of machinery for reducing the cost of production, while the Canada Copper Company has not operated the *Copper Mountain* during the whole of the year.

Conditions prevailing at the mines inspected during the year I have found to be good and the provisions of the "Metalliferous Mines Inspection Act" well adhered to, and when advised of any omissions these are immediately attended to. I have always found the managers of the different mines showing a desire to conform with requirements of the Act. It is also very gratifying to report that there have been no accidents at the metalliferous mines in this district during the year, which is a good record and goes to show that care is being taken by both workmen and officials.

The following is a brief description of the various mines that have been operated and plants improved during the year:—

Horn Silver. P. W. Powell, superintendent; operated by Powell Bros. and Mrs. Powell, Similkameen and Victoria. This mine is situated about 15 miles below Keremeos and 6 miles below the Similkameen Station, and is reached by a fairly good wagon-road used for hauling the ore from the mine to the depot on the Great Northern Railway. The mine is situated on the east side of the mountain at an elevation of 2,400 feet and about 1,100 feet above the mine camp.

There has been very little development-work done at this mine during the year, the ore being extracted from both the upper and lower levels. The roof, being of a rather fragile nature, necessitates a careful system of timbering; in the upper level the method of work is at present a modified system of long-wall, all waste material being thrown into the gob and used for packing the roof at the face, being well supported by means of posts and stulls. The method of work in the lower level is stoping.

There has been no change made with this plant during the year, the ore being brought out of the mine by means of small cars and dumped over a bar-screen and sorted, where it is loaded into buckets attached to an aerial tramway 3,000 feet in length and conveyed to the foot of the mountain, where it is automatically dumped into an ore-bin and hauled by teams to the depot at Similkameen.

During my inspections I have always found this mine to be in good condition, well timbered, and the provisions of the "Metalliferous Mines Inspection Act" well adhered to. Fifty-per-cent. Polar Forsite is used for blasting, which is stored in a magazine and only sufficient taken out for a day's supply. The only power used is a 50-horse-power gas-engine for driving a compressor having a capacity of 102 feet a minute, which is used for driving power-drills.

Nickel Plate. G. P. Jones, general manager; Wallace Knowles, superintendent. This mine is situated in the Osoyoos Mining Division, on the Nickel Plate mountain at an altitude of 5,500 feet and 3,800 feet above the town of Hedley, where the mill for treatment of ore is situated. The mineral is found in lenticular bodies developed by tunnels driven through the country-rock until the ore-bodies are reached. All the ore is taken

out by a 16 by 8 well-timbered slope (of 20°) provided with double tracks and a travelling-way, from which levels are started approximately every 100 feet.

Skips having a capacity of 2 tons of ore are operated by separate compressed-air engines situated at the top of the incline, are loaded at the various chutes and dumped into a common ore-bin, where the ore is loaded into a train of cars hauled by an electric trolly-motor to the top of the surface incline, where it is dumped into a large bin, from which it is drawn into skips which operate on this gravity-plane to the mill.

The gravity-tram is operated in two stages. The skips have a capacity of 5 tons. In the first stage the skips are lowered a distance of 4,000 feet on the incline to the central station, where they are transferred to the lower portion of the tramway and continue a distance of 6,000 feet, descending a total vertical distance during the trip of 3,800 feet.

This mine ceased operations in November, 1920. When work recommenced in May, 1921, it was of an exploratory nature, with about thirty men employed.

During the year the Dixon slope has been extended from the 1,080- to the 1,260-foot level, a distance of 180 feet, while the 102 on the 1,000-foot level has been extended 500 feet with diamond-drilling to prove the ore-bodies, with a little stoping. About 2,000 tons of ore was sent over the incline to the ore-bins at the mill during the year, which was utilized for a balance for the tramway in order to maintain haulage facilities for the transportation of equipment and supplies for the employees residing at the mine. Operations were again suspended during the month of November.

There has been no change made at this plant during the year, which consists of a 2,000-horse-power hydro-electric plant situated near the Similkameen river, 1 mile below the town of Hedley, which is used for driving a 400-horse-power, belt-driven, 17 by 28 by 36, 2-stage compressor, and one 2-stage compressor, 15 by 25 by 24, direct-driven by a 440-horse-power synchronous motor. An auxiliary steam plant consists of a single Goldie-Corliss engine, 21 by 30, directly connected to a 375-kw. generator, with a Doble water-wheel and Lombard governor attached; one 8 by 14 vacuum O pump, motor-driven, for Oliver filter at the mill; and three return-tubular boilers having an aggregate horse-power of 315, all situated at the mill.

Sixty-per-cent. Polar Forsite is used for blasting, all shots being fired by fuse and caps. During my inspections I have found the provisions of the "Metalliferous Mines Inspection Act" well adhered to and every precaution being taken to protect the workmen.

Iron Mask.

A. Wallinder, superintendent. This property consists of the *Iron Mask* and *Erin* and is situated about 7 miles south-east of the city of Kamloops at an elevation of 3,600 feet. Two shafts, the *Iron Mask* and the *Erin*, have been connected for ventilation purposes. The mineral consists of copper in the form of sulphides and carbonates. The power being used is electric and is transmitted over high-voltage wires from the city of Kamloops at a voltage of 11,000, and is cut down to 440 volts for use in and around the mine.

The mine has not been operated during the year owing to the unsatisfactory state of the copper market. Several improvements have been done by way of repairs to the *Iron Mask* shaft and the installation of new machinery and equipment for the better treatment and handling of the ore.

Repairs have been continued at the shaft during the year which has been retimbered with 14-inch square sets from the 150- to the 750-foot level. Ore-pockets have been enlarged to 250 tons capacity, with a waste-pocket of 75 tons capacity, and the 750 station considerably enlarged.

The mill crushing plant was increased by the addition of 42-inch rolls in conjunction with the Gates gyratory crusher, enabling to crush from 2-inch to ¾-inch mesh, which should appreciably increase the capacity of the ball-mill; also the mill storage-bins were increased to 500 tons capacity. The tailings settling capacity was doubled by the installation of a new 12- by 50-foot concrete Dorr thickener.

The filtering of the flotation concentrates, as well as the hauling of the same to the Canadian Pacific Railway siding, has been eliminated by the installation of a pipe-line and a series of settling-tanks at the loading-track. The pumping plant at the Thompson river, 3½ miles distant and 1,750 feet lower elevation, was completed, which will assure an ample supply of good water for both milling and domestic purposes.

During my inspections of this mine I have found the provisions of the "Metalliferous Mines Inspection Act" well adhered to, with good accommodations provided for the workmen.

COAST INSPECTION DISTRICT.

Report by James Dickson, Inspector.

I have the honour to submit my annual report as Inspector of Mines for the above district during the year ending December 31st, 1921.

Britannia.

E. J. Donohue, general manager; G. Nettleton, secretary-treasurer; C. P. Browning, superintendent. These mines, the property of the Britannia Mining and Smelting Company, are situated on Howe sound, about 28 miles from Vancouver, and are reached by a daily steamship service. Owing to the disturbed condition of the copper market at the end of 1920 this company was not operating on its usual large scale and none of the ore produced was milled. The ore was put into bunkers, where it is readily available when required, 47,380 tons being produced during the year and practically all in the first three months. The mill, which had been idle for several months, caught fire on March 19th, 1921, and was totally destroyed.

In the main operation a drift 186 feet long was driven on a 30° slope from the 1,800-foot to the 1,700-foot level, at which point a crusher-chamber was enlarged for the installation of the 24 by 36 jaw-crusher which previously operated on the 1,800-foot level, complementing the 7½-kw. gyratory crusher. With the above installation it is arranged to give a 2-stage preliminary crushing to the ore, reducing same to a 2½-inch ring before it leaves the mine.

Practically all the development-work has been done in the *Victoria* part of the property. The development footages were as follows: Drifts, 1,909 feet; crosscuts, 1,027 feet; raises, 3,194 feet; and winzes, 118 feet, giving a total footage of 6,248. There was no diamond-drilling during this period.

The hoisting equipment at the *Victoria* has been installed on the 1,900-foot level, and the ore below this will be hoisted to the 1,900-foot level and transported from the *Victoria* to the portal of the 1,600-foot level of the *Empress* by means of an aerial tramway. From this point the ore will be carried through the main operation to the 2,200-foot level, receiving, en route, the preliminary crushing referred to above.

Near the entrance to the *Victoria* mine a sawmill has been erected with a capacity of 30,000 feet a day, from which all the timber required is handled directly to the workings. A three-story 30- by 100-foot bunk-house and a 25- by 40-foot dry-house have been built to house and care for sixty-five men.

During the year the 1,400-foot raise from the 4,100-foot level (elevation of the top of the mill-bins) to the 2,700-foot level (elevation of head of the incline) was holed through and is now being put in order for the handling, between these points, the total production of the Britannia mines.

This raise, having a total height of 1,400 feet, was put through without an accident of any kind, although two men, engaged in drawing the muck from the raise after it had been holed, had a narrow escape owing to the midwall between the chute and the manway giving way and allowing the muck to fall down the manway, blocking and partly wrecking the same. Luckily the men were in a station (700 feet from the bottom) when this occurred and were not injured by the falling debris.

Rescue crews were immediately put to work to ascertain the fate of the two men and attempts were made to reach them from below, but after two days this was abandoned, as there appeared to be a greater likelihood of more men being lost than of reaching the missing men. An attempt to reach the men from the top was then made, and after five days' sinking and timbering through the loose debris the men were reached and found to be, apart from a little suffering from exposure, in fair condition. After being shut in for over seven days they were able, after receiving a little stimulant, to climb, unassisted, to the station above. Much credit is due to the management and men engaged in this difficult and dangerous rescue operation.

The company is now engaged in the preparation and construction of a new mill and concentrator embodying approved modern advances in the preparation of concentrates and having a capacity of 2,500 tons a day.

There was one fatal accident at this mine during 1921; this occurred near the portal of the *Victoria*, where a trammer was killed by a moving car.

The above mines were found to be well ventilated and the provisions of the "Metalliferous Mines Inspection Act" appear to be fully observed.

Bowena. This property is situated on the eastern shore of Bowen island, near Deep Cove, and is owned by the Bowena Copper Mines, Limited. The mine was operated for a few weeks by a small crew under H. Gerhardi and then closed down. The mine and mill (100 tons capacity daily) are very conveniently situated for shipping, as they are on the shore on the eastern coast of Bowen island about 12 miles by steamship from Vancouver.

Sunloch.—This property is situated near the mouth of Jordan river and is about 40 miles from Victoria. Apart from a little prospecting, nothing has been done at this property during 1921.

Clayburn. These mines are owned and operated by the Clayburn Brick Company and produce the different clays required in the manufacture of brick, firebrick, sewer-pipe, and other products of that nature. The seams of clay have a slight dip and are worked on the pillar-and-stall system, the places being driven 12 feet wide and 6 to 10 feet high. The roadways are well timbered and the ventilation, which is natural, is good. There was one fatal accident during 1921, a miner named De Lella being so severely injured by material from a shot that he died.

There are several openings in the different seams and the mines are worked intermittently, the same crew of men being moved from mine to mine according to the kind of clay required at that particular time. The mining operations are under the direction of Elijah Priest, mine manager.

NORTHERN INSPECTION DISTRICT.

REPORT BY T. J. SHENTON, INSPECTOR.

I have the honour to submit my annual report for the Northern Inspection District, consisting of the Portland Canal, Nass River, Skeena, Queen Charlotte, and Atlin Mining Divisions.

ATLIN MINING DIVISION.

This Division was not visited by me during the current year, as arranged by the Department; I therefore have no report for this section.

PORTLAND CANAL MINING DIVISION.

SALMON RIVER SECTION.

Premier. In this section is situated the *Premier* mine, operated by the Premier Gold Mining Company, Limited. D. L. Pitt, general manager; B. Smith, assistant manager; D. McDonald, mine superintendent. The mine is on the Salmon river, 14 miles from tide-water at the head of the Portland canal. The mine officials have been intensely active during the year in the erection of buildings, consisting of bunk-houses, dry and wash rooms; in the instalment of a steam-heating plant and a hospital, now completed, and in charge of Dr. G. E. Bayfield. In addition, the 150-ton mill has been completed and has been in operation for several months; the aerial tramway, 11½ miles long, has been completed and began operation about December 20th of this year. Two large compressors coupled to two Diesel units have been installed and are now in operation. A concrete foundation at Cascade creek has been put in ready for the machinery for the main power-house, which, it is expected, will be completed early in the spring of 1922. The mine has been in continuous operation during the year, excepting a two-week interval in May due to wage dispute.

The average number of men employed for the year was 382. Total length of tunnel and drifting, 4,027 feet; total of diamond-drilling accomplished for the same period, 6,821 feet. About 50 feet from entrance to No. 2 tunnel a small shaft, 5 by 6 feet, has been sunk during the year to a depth of 420 feet, connecting Nos. 3 and 4 workings; it is supplied with steel cage with guides and safety-catches, and is used for the purpose of hoisting and lowering men and material. Five persons are permitted to ride on each cage.

In the many visits of inspection made by me during the year I have found the management always ready to co-operate in the rigid operation of the law, and all matters within the mine and upon the surface to be proceeding in accordance with the "Metalliferous Mines Inspection Act."

Bear River Section.

Swamp Point. This mine is situated some 30 miles from Stewart, on the Portland canal, and is owned and operated by the Granby Consolidated Mining, Smelting, and Power Company. The mine was closed down for several months during the fall of 1920 and began operations again in the month of March of the present year. The material mined is limestone, which is shipped by scows to Anyox as flux for smelting purposes. The manager is Bert Wing, who was appointed when resumption of work took place. The average number of men employed was eight and the total output in limestone 15,734 tons. The entire operation I have found to be carried on in strict conformity to the stipulations of the "Metalliferous Mines Inspection Act."

NASS RIVER MINING DIVISION.

Observatory Inlet.

At the head of this inlet is situated the mines of the Granby Consolidated Mining, Smelting, and Power Company, the *Hidden Creek* and *Rambler*, in the locality of Anyox.

Hidden Creek. The official staff of present management consists of H. S. Munro, general manager; J. A. Bancroft, assistant manager; J. Tuttle, Jr., mine superintendent; and J. Swanson, mine foreman. Operations have been continuous through the year. Early in the year there was a loss by fire of the main crusher No. 2 at the mine, and another new crusher, No. 3, being prepared for future operation had to be hurriedly pushed to completion. The rebuilding and installation of the new No. 2 crusher was not completed until the month of October; the structure is concrete and fire-proof. E. E. Campbell, previously assistant manager, left the company's service early in the year and his place was filled by Dr. Bancroft.

This year the output of the mine for a single day was broken, being an increase over that of any other day's output in the history of the operation. The average number of men employed was 212, as against 385 for the year 1920. During the year there were two accidents which, while rather serious, were not fatal. The small number of accidents in so large an employment is in a very considerable measure due to the strict co-operation of the management in the application of the "Metalliferous Mines Inspection Act" and the commendable system of operation. On all occasions of my visits of inspection I have found all conditions respecting the "Metalliferous Mines Inspection Act" being rigidly adhered to.

Rambler. This mine is situated about 1½ miles directly west of the smelter-site and the product is quartz used for fluxing. The operation of the mine is under the charge of T. Oxley, and during the present year has not suffered one accident. In this, as that of the *Swamp Point* mine, part of the operation is on the surface, and the quartz produced on the surface is put down through chutes into the cars in the tunnel driven beneath, and from thence is carried by tram to the bunkers near to the smelter. It is found necessary at times to break the large lumps of quartz with hand-hammer before transporting, and to prevent the eyes of the men being injured by pieces of rock the company very willingly agreed, at the suggestion of the Inspector, to the use of wire goggles, a perfect preventive of accident in the case. The average number of men employed for the year was twenty-three and the tonnage in output 22,773 tons. In all inspections made during the year I have found the conditions to agree with the "Metalliferous Mines Inspection Act."

Golskiesh. This mine is situated about 3 miles south of Granby harbour on Deep bay; it is operated by the Golskiesh Mines, Limited, and is managed by W. H. Heidman. The product is a flux, which is sold to the Granby Consolidated Mining, Smelting, and Power Company and is conveyed from the mine to the wharves in Granby bay by the company's scows. A small gas-driven compressor furnishes the power for drilling purposes. The average number of men employed for the year was ten and the output was shipped to the Granby smelter. In all of my inspections of this operation during the year I have found the same to be carried on in accordance with the "Metalliferous Mines Inspection Act."

Alice Arm.

From the head of this arm a distance of 18 miles along the Kitsault river, in a north-easterly direction, is situated the mines of the Taylor Engineering Company. Connecting tide-water with the mines is a narrow-gauge railway, over which the ore from the mines is transported to the bunkers at the wharves situated at the head of the bay. The present management consists of C. B. North as general manager and J. Milligan as assistant manager.

Dolly Varden.—An unusually short period of operation took place this year; the mine was opened up in the early part of the month of August and closed down in the latter part of the month of September. For the time of operation there was employed on an average twenty-two men.

Wolf.—This property, operated by the same company, is 3 miles farther north from the *Dolly Varden* property, and during the present year, with the exception of the operation of the new power-house situated on this property, the mine has been idle. In my inspections of the operation I have found the prevailing conditions to be fairly in accord with the "Metalliferous Mines Inspection Act."

North Star.—This property joins that of the *Dolly Varden* mine and is owned by the McAleenan Bros., of Alice Arm, and is under the supervision of J. McAleenan. During the present year this property has been idle, and from the dump of the same about 85 tons of ore was shipped to the smelter by the *Dolly Varden* management.

OMINECA MINING DIVISION.

Skeena Section.

Silver Standard.—This mine is situated on Glen mountain in the vicinity of Hazelton. Owing to high prices of material, a low market for silver, and other disadvantages, such as freight rates of railway, etc., the mine was closed in the fall of 1920, and during the present year has remained so. The metal market having improved during the latter part of the present year, it is understood that the company expects to resume operations early in the coming year.

Delta Copper Co.—This company's mine is situated on the Rocher Déboulé hill in close proximity to that of the *Rocher Déboulé* mine, in the district of Hazelton. Under the supervision of Mr. Norrie-Lowenthal some diamond-drilling was done during the months of July and August and four men were employed. The work terminated at the end of August.

Hudson Bay Mountain.

Very little work has been done in this section this year. I made one visit to the properties owned by Mr. Aldridge, Donald Simpson, and Kelly, situated on this hill. These properties are situated about 13 miles from Smithers, and the *Premier* group, or *Kelly* claims, were in operation at the time of my visit, four men being employed. The *Victory* group and the *Aldridge* group were idle. The *Empire* group, owned by D. Simpson, was being developed at the time and the work was continued until the month of September, when Mr. Simpson ceased for the winter.

The Duthie Ship Company's representative, J. Turner, came in in the month of November and entered upon the further development of the properties owned by Mr. Aldridge, called the *Mamie* group of claims. At present two men are employed in development-work; also a cook.

Grouse Mountain.—This mine is situated on Grouse mountain, about twenty miles north-east of the town of Telkwa. It was under bond for the year 1920 to the Cassiar Crown Copper Company. The mine ceased operation in the fall of said year and has not resumed operation to present date.

QUEEN CHARLOTTE MINING DIVISION.

Moresby Island.—Within the harbour of Ikeda is situated the *Ikeda* mine, which ceased operation in July of year 1920. At the time the reason given by the secretary for the cessation of work was that the property had been taken over by a new Japanese mining company. The mine has remained closed since the fall of last year.

Collison Harbour.—Within this harbour is situated the *Thunder* group of claims, owned by Ike Thompson, of Jedway. During the present year these claims have been under option to a syndicate, I was informed, which intends to begin active operations in the spring of 1922.

Copper Island.—Work of development of this property by the owner, A. Heino, has proceeded during the year, but no shipments of ore have been made.

South Easter Mine, Graham Island.—This property has not done anything during the year.

Burnaby Island.—The *Mother Lode* and the *Bank of Commerce* claims of this island have been in operation on a small scale. Mr. Campbell and Wilds, the owners have done considerable development-work during the year.

Shuttle Island.—This group of claims, owned by a Vancouver party, has not done any development-work during the year.

Gold Harbour.—Two men have been employed on the claims of the *Early Bird* group, in the persons of T. S. Davey and Nels Pearson, during the year.

Blue Mule Group.—This group of claims within the Kootenay harbour is leased by J. H. Jones and Nels Larson, who have been developing the claims during the present year.

SKEENA MINING DIVISION.

Coast Section.

During the year the operation of the present holdings in the property of the *Drum Lummon* mine has been under the hands of a new ownership—Glenville A. Collins Engineering Company, Limited. Operations began in the middle of the summer and an average of four men was employed until nearly the end of the year. A small shipment of some 4 tons of ore was made in the month of October.

Belmont-Surf Inlet.

This mine is situated on Princess Royal island, about 100 miles south of Prince Rupert, and is owned by the Belmont-Surf Inlet Mines, Limited. The officers of the company in charge are: F. H. Penn, manager; P. W. Racey, engineer; and C. P. Seale, mine superintendent. The predecessor of Mr. Penn (F. W. Holler) left the service of the company in the month of April of the year, and Mr. Penn was promoted to take the position. The average number of men for the year will be 200. The number of accidents for the year was five, one of which was fatal. The internal workings of the mine from a safety standpoint are, if anything, in advance of similar conditions prevailing in many of the other mines of my district, but I regret that, notwithstanding, the percentage of accidents for the number of men employed has been considerably greater. For the violation of mine regulations, approved by the "Metalliferous Mines Inspection Act," Charles Palmergerg and Charles Graham were convicted during the present year and were each fined $10.

In the month of October of the year P. W. Racey, engineer of the company, with other officers of the company, including Dr. Allen Beach, has taken pains in raising a class of seventy students in the study of first-aid work, which is a very creditable beginning. The matter is of the most intense necessity and will be of the greatest possible help in rendering efficient aid to the injured, and an important aid to the prevention of accident in the possession of more knowledge among the employees.

Pugsley.

This property, also owned by the Belmont-Surf Inlet Mines, Limited, emerged into a full mine in the month of October of the present year; development on a small scale had been continued during the former part of the year. Only a few men, some four or six, had been previously employed up to the month of October, after which preparations were being made for the increase necessary for a larger production. A short distance from the mouth of the mine the company has built ore-bins in size 150 tons, into which the output of the *Pugsley* mine will be delivered. A connection by aerial tram from this point to the ore-bins at the head of the *Surf* mine; it is a 2-bucket, high-speed, reversible type; capacity of bucket, 1,500 lb.; span between terminals, 2,300 feet; operated by a 25-horse-power motor. Capacity of tram in eight hours is 100 tons and elevation between terminals is 390 feet. In my inspections of both these properties during the year I have found the conditions to agree fairly with the "Metalliferous Mines Inspection Act."

COAL-MINING IN BRITISH COLUMBIA.

By Wm. Fleet Robertson, Provincial Mineralogist.

During the year 1921 there was mined in the various collieries of the Province 2,569,639 tons (2,240 lb.) of coal, a decrease from the preceding year of 127,135 tons, equivalent to about 4.3 per cent.

The output of coke was 59,434 tons as compared with 67,792 tons in 1920, a decrease of 8,358 tons or 12.3 per cent.

The following table shows, for the past eleven years, the output and the *per capita* production of the various districts:—

Output and Per Capita Production of Various Districts.

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1911	East Kootenay District	442,057	2,197	201	1,585	272
	Coast District	1,855,661	4,676	397	3,627	511
	Whole Province	2,297,718	6,873	334	5,212	440
1912	East Kootenay District	1,261,212	2,410	523	1,780	708
	Coast District	1,764,497	4,720	374	3,495	504
	Whole Province	3,025,709	7,130	424	5,275	574
1913	East Kootenay District	1,331,725	2,666	500	1,965	678
	Coast District	1,239,035	3,777	328	2,865	433
	Whole Province	2,570,760	6,443	399	4,830	532
1914	East Kootenay District	955,183	2,397	399	1,749	547
	Coast District	1,211,245	3,335	363	2,518	481
	Whole Province	2,166,428	5,732	379	4,267	508
1915	East Kootenay District	852,572	1,748	488	1,183	721
	Coast District	1,120,008	3,230	347	2,512	446
	Whole Province	1,972,580	4,978	396	3,695	534
1916	East Kootenay District	882,270	1,674	527	1,125	784
	Coast District	1,603,310	3,386	474	2,569	624
	Whole Province	2,485,580	5,060	491	3,694	673
1917	East Kootenay District	551,751	1,481	372	944	584
	Coast District	1,846,964	3,689	501	2,816	656
	Whole Province	2,398,715	5,170	463	3,760	638
1918	East Kootenay District	732,864	1,327	552	814	900
	Coast District	1,845,860	4,100	450	2,844	645
	Whole Province	2,578,724	5,427	475	3,658	705
1919	East Kootenay District	558,806	1,369	409	1,000	559
	Coast District	1,850,142	4,597	402	3,145	588
	Whole Province	2,408,948	5,966	404	4,145	581
1920	East Kootenay District	847,389	1,582	536	1,062	798
	Coast District	1,849,385	4,767	388	3,129	591
	Whole Province	2,696,774	6,349	425	4,191	643
1921	East Kootenay District	759,755	1,774	428	1,207	629
	Coast District	1,809,884	5,111	354	3,515	515
	Whole Province	2,569,639	6,885	373	4,722	544

While no figures can be given as to the actual cost of mining in the different fields, the *per capita* production of these fields is of interest, as having a bearing upon the working costs and as indicating the mining facilities existing and the improvement made in these conditions from year to year.

The *per capita* production varies from year to year and this variation is very often caused by different conditions which last for a longer or shorter time. For example, explosions, new developments, and the opening-up of new mines or closing of old ones are variable factors which affect the *per capita* production from year to year.

It will be seen from the foregoing table that the production *per capita* was high in 1912, but that the years 1913, 1914, 1915, and 1919 show a decrease, especially in the Coast District. This decreased effectiveness, during the last few years, of the labour employed is largely due to the extension of the workings of the mines, causing a greater length of haulage and greater extent of old workings to be taken care of, but some of the increased labour is undoubtedly on account of the greater number of men employed in safeguarding the mine and workmen. In the year 1917 it will be observed that while the *per capita* output of the Coast collieries also shows an increase, the Crowsnest District shows a very considerable decrease, which is caused by the fact that a large amount of the underground labour in these collieries is engaged in non-productive work, such as repairing the damage from the former explosion and in opening up a new system of mining which it is expected will tend to greater safety of employees and also of the property.

The *per capita* production for 1920 shows a substantial increase over that of 1919, particularly in the East Kootenay District, but it is to be regretted that in 1921 the *per capita* production has fallen back again.

The market of the East Kootenay field is provided primarily by the railways of the south-eastern part of the Province and of the northern parts of the adjoining States of Montana and Washington, approximately three-quarters of the coal, sold as such, being exported to those States, while the remainder went to supply the demands of the south-eastern part of the Province —its domestic needs, its railways, steamboats, mines, and smelters. The competition of fuel-oil, frequently referred to in the past, has diminished to some extent owing to increased prices of fuel-oil.

Coke, a product of the coal-mines, is sold in the same markets, with the difference that the local consumption—chiefly by the smelter at Trail—took about 70 per cent. of the product, while 30 per cent. was exported to the States mentioned.

As regards the marketing conditions in this field, the East Kootenay collieries are, however, brought into direct competition with the collieries of Alberta, just over the Provincial boundary-line, all these collieries being in the same coalfield, with practically the same grade of coal and working under similar conditions.

The Coast District may be subdivided into two fields—the Nicola-Princeton field and the Vancouver Island field—in which the markets differ considerably.

The new coalfield on the Telkwa river, in Omineca Division, this year produced 800 tons of coal which was sold locally. The production of this field has been included in the Coast District.

In the Nicola-Princeton field the consumption is chiefly by the local railways, while a small amount finds its way to Vancouver, even under the handicap of what seems to be an excessively high freight charge.

The Vancouver Island coal market is provided by the domestic and manufacturing requirements of the Coast cities, and of the ocean-going steamers calling at these ports.

The larger coasting steamers and railways, which in later years have all been using California crude oil as fuel, are to some extent reverting to the use of coal, which will mean an increased production from Coast collieries.

As in former years, the greater proportion of the coal production was made by three larger companies—the Crow's Nest Pass Coal Company, with two collieries in East Kootenay; and by the Western Fuel Corporation (formerly Canadian Western Fuel Company), of Nanaimo, and the Canadian Collieries (Dunsmuir), Limited, these last two operating on Vancouver island.

In addition to these large collieries, shipments have been made by the Corbin Coal and Coke Company, in East Kootenay; by the Middlesboro Collieries, Fleming Coal Company (operating Coal Hill Colliery), Coalmont Collieries, Limited, in the Nicola Valley, and the Chu Chua

Colliery, on the North Thompson river; by the Princton Coal and Land Company, of Princeton; by the Pacific Coast Coal Mines, Limited, East Wellington Coal Company (formerly British Columbia Coal Mining Company, which was the Vancouver Nanaimo Coal Company), and Nanoose Collieries, Limited, all operating on Vancouver island, near Nanaimo; and by Granby Colliery No. 1 at Cassidy. Telkwa Collieries Company, of Telkwa, did not produce in 1921, but a new colliery—the Aveling Colliery—mined and sold locally 800 tons,

The details of the shipments made by each of these companies will be found in reports of the Inspectors of the various districts.

During the year 1921 about 60.9 per cent. of the coal, sold as such by the collieries of the Province, was consumed in British Columbia; and the remainder, 39.1 per cent., was exported to the United States, including Alaska. Of the coke sold, about 70 per cent. was consumed in British Columbia, and the remaining 30 per cent. was exported to the United States.

COLLIERIES OF THE COAST DISTRICT.

The gross output of the Coast District collieries, including the Nicola valley and Telkwa, for the year 1921 was 1,809,884 tons (2,240 lb.) of coal actually mined, while some 24,330 tons was taken from "stock," making the actual consumption of coal 1,834,214 tons.

Of this gross consumption, 1,485,415 tons was sold as coal, 152,898 tons was consumed by the producing companies as fuel, and 190,148 tons was lost in washing. No coke was made this year by the Coast collieries, but coal mined at some of the Vancouver Island collieries was sold to the Granby Company's Anyox smelter, where it was subsequently made into coke in by-product ovens by the Smelting Company for its own use.

Formerly, in 1902, the Coast collieries exported to the United States 75 per cent. of the coal they mined, but later these conditions changed very much, as is shown by the following table:—

TABLE SHOWING PERCENTAGE SALES DISTRIBUTION OF COAST DISTRICT COAL.

Year.	Used in Canada.	Exported to U.S.	Exported to other Countries.
1910	71.30	24.50	....
1911	76.10	21.60	2.30
1912	71.25	21.25	7.47
1913	89.80	10.20	....
1914	77.30	22.70	....
1915	67.00	33.00	....
1916	63.00	37.00	....
1917	60.00	37.00	3.00
1918	66.00	30.00	4.00
1919	72.00	28.00	....
1820	79.00	20.00	1.00
1921	78.47	21.53	....

COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1921 was 759,755 tons (2,240 lb.) of coal actually mined, while 13,859 tons was added to stock, making the actual consumption of coal 745,896 tons. Of this gross consumption of coal, 599,592 tons was sold as coal, 60,660 tons was consumed as fuel by the producing companies, while 85,644 tons was converted into coke, producing 59,434 tons of coke; 536 tons of coke was taken from stock, making the coke sales for the year 59,970 tons.

The East Kootenay collieries exported to the United States about 70 per cent. of the coal sold and about 35 per cent. of the coke.

The following table gives complete details of the coal and coke production of the Province for 1921, with the output figures for each colliery and district totals:—

Collieries of British Columbia—Production, 1921.

Mine.	Sold.			Total Sales.	Lost in Washing.	Used in making Coke.	Used under Co.'s Boilers, etc.	Total for Colliery Use.	Stocks.		Difference.		Output for Year 1921.
	In Canada.	In U.S.	Other Countries.						First of Year.	Last of Year.	Added to.	Taken from.	
Vancouver Island.													
Canadian Collieries (D), Ltd—	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
South Wellington	59,671	.....	.....	59,671	26,291	.....	4,633	30,924	.....	.....	.....	.....	90,595
Extension	89,439	57,204	.....	146,643	38,200	.....	18,472	56,672	1,458	3,342	1,884	.....	205,199
Cumberland	338,798	20,191	.....	358,989	67,856	.....	12,426	80,282	4,972	6,387	1,415	.....	440,686
Canadian Western Fuel Co.—													
No. 1, Nanaimo	193,554	72,968	.....	266,522	.....	.....	25,060	25,060	3,946	2,523	.....	1,423	290,159
Harewood	22,502	8,483	.....	30,985	.....	.....	11,493	11,493	7,170	8,434	1,264	.....	43,742
Reserve	101,351	38,208	.....	139,559	.....	.....	25,507	25,507	.....	.....	.....	.....	165,066
Wakesiah	33,414	12,596	.....	46,010	.....	.....	20,622	20,622	.....	435	435	.....	67,067
Old Wellington (King & Foster)	4,101	.....	.....	4,101	.....	.....	19	19	.....	100	100	.....	4,220
Nanoose-Wellington	38,977	5,902	.....	44,879	.....	.....	5,682	5,682	1,010	655	.....	355	50,206
Pacific Coast Coal Mines, Ltd.—													
Morden	14,205	800	.....	15,005	.....	.....	3,516	3,516	19,006	514	.....	18,492	29
Suquash	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Granby Cons. M. S. & P. Co.—													
Cassidy	125,677	75,161	.....	200,838	57,801	.....	14,383	72,184	5,437	1,377	.....	4,060	268,962
Totals, Vancouver Island	1,021,689	291,513	.....	1,313,202	190,148	.....	141,813	331,961	42,999	23,767	5,098	24,330	1,625,931
Nicola-Princeton District.													
Chu Chua Mine Syndicate	1,685	200	.....	1,885	.....	....	275	275	.....	.....	.....	.....	2,160
Middlesboro Collieries, Ltd	4,733	.....	.....	64,733	.....	.....	2,689	2,689	134	504	370	.....	67,792
Fleming Coal Co., Ltd	34,330	.....	.....	34,330	.....	.....	1,561	1,561	100	100	.....	.....	35,891
Princeton Coal & Land Co	9,804	952	.....	10,756	.....	.....	2,925	2,925	33	318	285	.....	13,966
Coalmont Collieries, Ltd	32,264	27,445	.....	59,709	.....	.....	3,635	3,635	.....	.....	.....	.....	63,344
Totals, Nicola-Princeton District	142,816	28,597	.....	171,413	.....	.....	11,085	11,085	267	922	655	.....	183,153
Telkwa District.													
Telkwa Collieries, Ltd	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Aveling Coal Property	800	.....	.....	800	.....	.....	.....	.....	.....	.....	.....	.....	800
Totals, Telkwa District	1,165,305	320,110	.....	1,485,415	190,148	.....	152,898	343,046	43,266	24,689	5,753	24,330	1,809,884
Crowsnest Pass District.													
Crow's Nest Pass Coal Co., Ltd—													
Coal Creek	49,535	320,410	.....	369,945	.....	.....	36,621	36,621	120	7,077	6,957	.....	413,523
Michel	35,932	133,889	.....	169,821	.....	85,644	19,383	105,027	.....	3,453	3,453	.....	278,301
Corbin Coal & Coke Co., Ltd	18,794	41,032	.....	59,826	.....	.....	4,656	4,656	5,765	9,214	3,449	.....	67,931
Totals, Crowsnest Pass District	104,261	495,331	.....	599,592	.....	85,644	60,660	146,304	5,885	19,744	13,859	.....	759,755
Coal.													
Total for Province	1,269,566	815,441	.....	2,085,007	190,148	85,644	213,558	489,350	49,151	44,433	19,612	24,330	2,569,639
Coke.													
Total for Province (from Michel)	41,878	18,092	.....	59,970	.....	.....	.....	.....	580	44	.....	536	59,434

COLLIERIES OF BRITISH COLUMBIA—MEN EMPLOYED, 1921.

The following table shows the men employed at each colliery in the Province during 1921 and district totals:—

Mine.	White Men.																Indians.			Japanese and Chinese.									Total Men employed.		
	Supervision and Clerical.			Miners.			Helpers.			Labourers.			Mechanics and Skilled.			Boys.			Labourers.			Miners.			Helpers.			Labourers.					
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.
Vancouver Island.																																	
Canadian Collieries (D.), Ltd.—																																	
South Wellington	8	3	11	147	..	147	..	..	..	39	11	50	13	12	25	..	5	5	..	..	..	..	..	..	..	..	..	..	21	21	207	52	259
Extension	28	19	47	280	..	280	11	..	11	111	39	150	40	46	86	..	20	20	..	..	..	..	..	..	..	..	..	5	56	61	475	180	655
Cumberland	52	33	85	148	..	148	..	..	..	119	103	222	68	149	217	10	19	29	..	..	..	160	..	160	..	.	..	265	195	460	822	499	1,321
Canadian Western Fuel Co.—																																	
No. 1 Nanaimo	27	22	49	201	..	201	..	..	..	175	98	273	97	44	141	37	14	51	..	..	..	..	..	..	.	..	..	..	50	50	537	228	765
Harewood	8	4	12	75	..	75	..	.	..	33	27	60	10	16	26	5	14	19	..	..	..	..	..	..	..	..	..	..	18	18	131	79	210
Reserve	13	12	25	163	..	163	..	..	..	69	54	123	26	30	56	29	15	44	3	..	3	..	..	..	..	..	..	..	31	31	303	142	445
Wakesiah	8	4	12	74	..	74	..	..	..	29	24	53	22	19	41	11	7	18	..	..	..	..	..	..	..	..	..	..	10	10	144	64	208
Old Wellington	2	2	4	10	..	10	..	..	..	5	5	10	..	1	1	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	17	10	27
Pacific Coast Coal Mines—																																	
Morden	1	3	4	..	..	..	..	..	..	..	4	4	..	7	7	..	3	3	..	..	..	..	..	..	..	..	..	..	6	6	1	23	24
Suquash	1	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	2
Granby Cons. M. S. & P. Co.—																																	
Cassidy	16	16	32	222	..	222	..	..	..	..	31	31	106	72	178	.	13	13	..	..	..	..	..	..	..	..	..	..	..	..	344	132	476
Nanoose	11	5	16	91	..	91	29	..	29	52	14	66	6	18	24	8	..	8	..	..	..	..	..	..	..	..	..	..	14	14	197	51	248
Totals, Vancouver Island	175	124	299	1411	..	1411	40	..	40	632	410	1042	388	414	802	100	112	212	3	..	3	160	..	160	..	..	..	270	401	671	3179	1461	4,640
Nicola-Princeton District.																																	
Chu Chua Mine Syndicate	2	..	2	8	..	8	4	..	4	..	3	3	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	14	6	20
Middlesboro Collieries, Ltd	12	5	17	54	..	54	33	..	33	44	18	62	..	18	18	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..	143	49	192
Fleming Coal Co., Ltd	5	2	7	38	..	38	5	..	5	5	16	21	5	7	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	58	25	83
Princeton Coal & Land Co	4	2	6	14	..	14	..	..	..	18	8	26	..	7	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36	17	53
Coalmont Collieries, Ltd	6	7	13	50	..	50	..	..	..	22	22	44	..	6	6	2	1	3	..	..	..	..	..	..	.	..	..	..	1	1	80	37	117
Totals, Nicola-Princeton District	29	16	45	164	..	164	42	..	42	89	67	156	5	40	45	2	9	11	..	..	..	..	..	..	..	..	..	..	2	2	331	134	465
Coast District.																																	
Telkwa River and Aveling Colliery	1	..	1	3	..	3	..	..	..	1	1	2	..	..	....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	1	6
Totals, Coast District	205	140	345	1578	..	1578	82	..	82	722	478	1200	393	454	847	102	121	223	3	..	3	160	..	160	..	..	..	270	403	673	3515	1596	5,111
Crowsnest Pass District.																																	
Crow's Nest Pass Coal Co—																																	
Coal Creek	27	10	37	378	..	378	..	..	..	263	69	332	26	120	146	8	8	16	..	..	..	..	..	..	..	..	..	..	..	..	702	207	909
Michel	17	13	30	249	..	249	..	..	..	123	181	304	22	96	118	4	9	13	..	..	..	..	..	..	..	..	..	..	6	6	415	305	720
Corbin Coal & Coke Co	7	9	16	45	..	45	38	..	38	..	35	35	..	10	10	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	90	55	145
Totals, Crowsnest Pass District	51	32	83	672	..	672	38	..	38	386	285	671	48	226	274	12	18	30	..	..	..	..	..	..	..	..	..	..	6	6	1207	567	1,774
Total for Province	256	172	428	2250	..	2250	120	..	120	1108	763	1871	441	680	1121	114	139	253	3	..	3	160	..	160	..	..	..	270	409	679	4722	2163	6,885

NOTE.—U=underground; A=above ground; T=total.

INSPECTION OF COAL-MINES, 1921.

The coal-producing areas of the Province are divided into the Coast District, which includes the Vancouver Island, the Nicola-Princeton, and the Telkwa coalfields, and the East Kootenay District.

COAST DISTRICT.

This district, comprising, as it does, the coalfields of Vancouver island and the Coast, as well as those of the Nicola and Similkameen valleys, has been subdivided, for inspection purposes, into three Inspection Districts.

Two of these Inspection Districts are on Vancouver island, with headquarters for both at Nanaimo, which permits of one of the Inspectors being constantly at headquarters while the other is making inspections; it also permits of the interchanging of inspection duties, so that each Inspector knows both districts.

The third district is the Nicola-Princeton Inspection District, with headquarters at Merritt. In June, 1920, John G. Biggs was appointed to the inspectorate of this district.

NANAIMO INSPECTION DISTRICT.

Henry Devlin, Inspector (Office, Nanaimo).

The Canadian Collieries (Dunsmuir), Limited—Nos. 1, 2, and 3 mines, all worked from what is known as the No. 1 tunnel, and No. 5 mine at South Wellington.

Granby Colliery No. 1 at Cassidy—3 slopes.

Pacific Coast Coal Mines, Limited—The Morden mine.

Nanoose Collieries, Limited—No. 1 mine.

Western Fuel Corporation of Canada (formerly Canadian Western Fuel Company)—Harewood, Reserve, and Wakesiah.

East Wellington Coal Company.

Adit mine, Old Wellington Colliery.

COMOX INSPECTION DISTRICT.

(Including No. 1 and Protection Shafts, Nanaimo.)

Thomas R. Jackson, Inspector (Office, Nanaimo).

Western Fuel Corporation of Canada (formerly Canadian Western Fuel Company)—Protection and No. 1 mines.

The Canadian Collieries (Dunsmuir), Limited—Nos. 4 and 7 slopes and No. 5 shaft.

Pacific Coast Coal Mines, Limited—Suquash Colliery.

NORTHERN INSPECTION DISTRICT.

T. J. Shenton, Inspector (Office, Prince Rupert).

The Telkwa Collieries—Mine at Telkwa; and the Aveling Colliery, also on Telkwa river.

NICOLA-PRINCETON INSPECTION DISTRICT.

John G. Biggs, Inspector (Office, Merritt).

The collieries operating during the year in this Inspection District, including the new mines that have been started, were:—

The Middlesboro Colliery of the Middlesboro Collieries, Limited, Merritt—Nos. 2, 3, 4, 5, 6, and 7 mines.

Fleming Coal Company.

Princeton Coal and Land Company's Princeton Colliery—No. 1 slope.

Coalmont Collieries.

Chu Chua Colliery.

EAST KOOTENAY DISTRICT.

The East Kootenay District is subdivided into two Inspection Districts—i.e., Northern Inspection District and Southern Inspection District. Both these districts are inspected by Robert Strachan as Senior Inspector, and John McDonald, Inspector with headquarters at the Mine-rescue Station at Fernie.

The collieries operating during the year were Coal Creek Collieries, Michel Colliery, and Corbin Colliery.

NANAIMO INSPECTION DISTRICT.

REPORT BY HENRY DEVLIN, INSPECTOR.

I have the honour to submit my annual report for the year ending December 31st, 1921, on the various coal-mines in my inspectorate, consisting of the Reserve, Harewood, and Wakesiah mines of the Western Fuel Corporation of Canada, Limited, Nanaimo (formerly Canadian Western Fuel Company); Nos. 1, 2, and 3 mines. Extension, and No. 5 mine, South Wellington, Wellington-Extension Colliery of the Canadian Collieries (Dunsmuir), Limited; Granby No. 1 Colliery of the Granby Consolidated Mining, Smelting, and Power Company, operating at Cassidy; Lantzville mine of the Nanoose-Wellington Collieries, operating at Nanoose; and the Old Wellington Colliery, Wellington, operated by King & Foster.

Western Fuel Corporation of Canada, Ltd.

(UNTIL JUNE 1ST, 1921, KNOWN AS THE CANADIAN WESTERN FUEL COMPANY.)

Head Office—Nanaimo, B.C.

Capital, $1,500,000.

Officers.	*Address.*
C. P. Heaton, President,	San Francisco, Cal.
G. W. Bowen, Vice-Chairman,	Nanaimo, B.C.
Mark Bate, Jr., Secretary-Treasurer,	Nanaimo, B.C.
John Hunt, General Superintendent,	Nanaimo, B.C.
Robert Laird, Mine Manager, No. 1 Mine,	Nanaimo, B.C.
Robert Henderson, Mine Manager, Reserve Mine,	Nanaimo, B.C.
Arthur Newbury, Harewood Mine,	Nanaimo, B.C.
William H. Moore, Wakesiah Mine,	Nanaimo, B.C.

The above company has operated the following collieries at Nanaimo during the past year, namely: No. 1 or Esplanade shaft, Nanaimo; Protection Island mine, Harewood, and Reserve.

The following returns show the combined output of all the company's mines for the past year:—

AGGREGATE RETURNS FROM WESTERN FUEL CORPORATION'S MINES FOR YEAR 1921.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	350,821			
" export to United States	132,255			
" " other countries				
Total sales		483,076		
Used in making coke				
" under colliery boilers, etc.	82,682			
Total for colliery use		82,682		
Stocks on hand first of year	11,116			
" last of year	11,392			
Difference added to stock during year		276		
Output of colliery for year		566,034		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	56		42		98	
Whites—Miners	513				513	
Miners' helpers						
Labourers	306		203		509	
Mechanics and skilled labour	155		109		264	
Boys	82		50		132	
Japanese						
Chinese			109		109	
Indians	3				3	
Totals	1,115		513		1,628	

NANAIMO COLLIERY.

Report by Thos. R. Jackson, Inspector.

Robert Laird, Manager.

No. 1 Shaft, Esplanade.

Edward A. Courtenay, Overman; Robert Adams, William Johnson, William Halliday, John Hamilton, James McMeakin, James Dudley, Thomas Blenkhorne, George Gardine, Joseph Dykes, Joshua Norris, Thomas J. Woods, George Perry, John Shipley, Joe Dean, Andy Bennett, George Moore, Joe Dykes, and Neil McMillan, Firebosses.

This mine is situated at the south end of the Esplanade and adjacent to the bay shore-line. It is the oldest working-pit in Nanaimo district and has a large submarine area. The mine has three openings; two of them are in daily operation—namely, No. 1 and Protection shafts. The latter is situated on Protection island. The third opening is Newcastle shaft. A ladder extends from top to bottom of this shaft, so that one can enter or leave the mine. It is used only for inspection or necessity; it also forms the exit for the return air of Newcastle airway. The men working in Protection mine are conveyed by scow to and from there. No. 1 shaft provides passage-way for men employed in the South side of mine.

Electric lamps of the Edison type are now used. Douglas and Newcastle seams are worked. On the South side of mine the Douglas seam is worked exclusively; on the North side of mine coal is taken from both seams. In blasting nothing but permitted explosives are used and fired by cable and electric battery. Compressed air and electricity are used as motive power for haulage and drainage purposes. The three Prescott pumps are driven by steam; so are the endless haulage-rope and Diagonal slope engines; all of them situated at the shaft-bottom.

The North side haulage system consists of heavy steel rails and copper trolly-wire on the Main level, approximately 3 miles in length, extending from No. 1 shaft to the foot of Lamb's incline. Five motors are used; four constantly running; one acts as spare. Four of them are of the Edison type and one Westinghouse type—10-ton; all are spring-trolly connected. Horses and mules with drivers are used to take the cars to the faces and return with loaded cars to the main roads. Small and large winches are employed to attend to these cars and place them on the motor-road; the motors haul them to the shaft-bottom. A 12-ton Jeffrey motor has been added lately.

The South side haulage system consists of direct, endless rope, and main and tail rope. The workmen are supplied with cars in a similar manner to North side of mine, with this difference: instead of motors hauling the cars to the shaft-bottom, engines and ropes are used to do the work.

Development-work done in South Side, No. 1 Mine.

In the Main slope the two rock tunnels known as No. 8 South levels have been driven in a distance of 600 feet, but so far only small pockets of coal have been found. No. 5 North levels

off the Main slope have been driven in a distance of 700 feet, but only one small pocket of coal has been struck.

In No. 3 dips off No. 3 North level reopening-work has been carried on since May. Some good coal has been found in this section, but owing to heavy water and the difficult nature of the ground reopening-work has been slow. At a point 1,000 feet in No. 3 level active development-work has been carried on in a large area on the West side; the results have been very satisfactory in this section.

No. 4 South levels off the Diagonal slope have been continued to a point about 2,000 feet from the slope with good results. About the middle of the year the old workings known as Old Diagonal slope, which had been standing full of water since the explosion thirty-four years ago, was successfully tapped and all water drained off. Owing to the irregular nature of the ground six bore-holes from 75 to 100 feet deep were put in before water was struck. In No. 1 slope off the main and tail roadway a rock tunnel has been driven in a distance of 250 feet with good results.

Development-work done in North Side of No. 1 Mine.

During the year active operations have been carried out in the Douglas seam at Lamb's incline. At this point the coal is only 2 feet 9 inches thick, but is of good quality. The main air-line was extended along the Main level from No. 3 wall entrance to Lamb's incline and the Pick-quick machines introduced with good results. This section is worked in the long-wall system, mining being done in the bottom.

In the Diagonal slope, Protection, reopening-work has been carried on during the year. The water has been pumped out for a distance of 1,400 feet from the shaft. At a point down the slope (750 feet) a long-wall section has been opened up on the North side. This section had to be abandoned some time ago as the coal got too thin to work.

Reopening-work is also being carried on in Protection slope. The water has been pumped out to a point 1,300 feet from the shaft and some good coal is being recovered. No. 1 and No. 2 inclines have also been reopened. Pillar-work is carried on under restrictions.

North Side, No. 1 Shaft.

In the Douglas seam the work done is chiefly the extraction of pillars; the thickness of the seam varies from 3 to 7 feet. The Newcastle seam averages 3 feet in thickness and is worked by the long-wall system. Most of the output of coal is produced by mining-machines. The machines used are Pick-quick and Siskoll. Where the ground is faulty or the face is not extensive the mining is done by a Siskoll machine; where there is sufficient length of face to warrant it the Pick-quick machine is used. Both machines give good results. Compressed air is the motive power. Both machines undercut the coal to a depth of 6 feet, after which it is drilled and shot down. The brushing is taken out the floor to admit the car to the face; car carries about 16 cwt. of coal. Regulation size of place equals 12 yards, with roadway in centre. Loaders load out the coal into cars. Eight loaders are supervised by one shotlighter, or fireboss. Four loaders are supervised by one faceman, who is a certificated miner; a loader does not need a miner's certificate to load coal. Portions of the long-wall face are worked by diggers.

At present coal from the pillars in the Douglas seam is being taken from the following sections in the North side of mine: No. 1 wall, No. 2 wall, Protection slope, and Lamb's incline.

The ventilation of these districts is produced by a Guibal fan, 9 by 18 feet, rope-driven, at 70 revolutions a minute, against a 2-inch water-gauge. During my last inspection I measured 47,000 cubic feet of air a minute passing up Protection slope, divided into four splits.

Protection Level Section.—There was 8,000 cubic feet of air a minute passing for the use of thirty-six men and seven horses. Found no gas and section free from coal-dust. General conditions fairly good.

Lamb's Incline Section.—There was 6,000 cubic feet of air a minute passing for the use of twenty-seven men and seven mules. Found no gas and section free from coal-dust. General conditions good.

Nos. 3 and 4 Long-wall Sections.—There was 11,200 cubic feet of air a minute passing for the use of fifty-six men and eight mules. Found no gas and section free from coal-dust. General conditions good.

Nos. 1 and 2 Walls, Upper Seam Section.—No. 1 Upper: There was 6,000 cubic feet of air a minute passing for the use of thirty-five men and five mules. Found no gas and section fairly free from coal-dust. General conditions good. No. 2 Upper: There was 7,000 cubic feet of air a minute passing for the use of twenty-six men and four mules. Found no gas and section fairly free from coal-dust. General conditions good.

Measured 20,400 cubic feet of air a minute passing in Newcastle airway. Last test of Burrell gas-detector showed 0.2 per cent. methane. In 73,500 cubic feet of air a minute passing near upcast shaft, last test of Burrell gas-detector showed only 0.1 per cent. of methane.

South Side, No. 1 Mine.

Alex. Coombs, James S. Brown, William Neave, George B. Bradshaw, John Marrs, John Weeks, John Sutherland, Matthew Broderick, John Devlin, and John McArthur, Firebosses.

The workings are all in the Douglas seam and almost consist of extractions of pillars. The seam varies much in thickness and inclination; some of it 2 feet and other parts as high as 15 feet; inclination running from horizontal to 10°.

The ventilation is produced by a 72- by 90-inch double-inlet Sirocco fan, rope-driven, ratio 3½ to 1, capable of producing 195,000 cubic feet of air a minute at a 4-inch water-gauge, driven by an engine of 350 horse-power. Another fan capable of producing the necessary ventilation of the mine stands ready to substitute should necessity require.

During my last inspection I measured 43,200 cubic feet of air a minute passing, divided into two splits.

No. 4 South Level Section.—There was 11,160 cubic feet of air a minute passing for the use of thirty-five men and seven mules. Got a little gas in Lewis place. Found section fairly free from coal-dust and general conditions good.

Inside Section.—There was 15,000 cubic feet of air a minute passing for the use of forty-eight men and nine horses. Found no gas and section of mine fairly free from coal-dust. General conditions of mine fairly good.

No. 7 Section.—There was 11,200 cubic feet of air a minute passing for the use of seven men and one horse. Found no gas and section free from coal-dust. General conditions good.

Burrell gas-detector showed 0.1 per cent. of methane in 22,300 cubic feet of air a minute passing in South side return at No. 3 door. Got 69,000 cubic feet of air a minute passing into upcast shaft from South side main airway; last test showed no methane.

The following are the official returns for the Nanaimo Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	193,554			
" export to United States	72,968			
" " other countries				
Total sales		266,522		
Used in making coke				
Used under colliery boilers, etc.	25,060			
Total for colliery use		25,060		
		291,582		
Stocks on hand first of year	3,946			
" last of year	2,523			
Difference taken from stock during year		1,423		
Output of colliery for year		290,159		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	27		22		49	
Whites—Miners	201	8.37			201	
Miners' helpers						
Labourers	175	4.81-5.35	98	4.88-5.33	273	
Mechanics and skilled labour	97	5.35-6.02	44	5.42-6.68	141	
Boys	37	2.58-4.81	14	1.74-3.89	51	
Japanese						
Chinese			50	2.34-3.11	50	
Indians						
Total	537		228		765	

REPORT BY HENRY DEVLIN, INSPECTOR.

RESERVE MINE.

Robert Henderson, Manager; Frances John, Overman; James McGrath, Shiftboss; Benjamin Cheetham, Albert Manifold, Joseph Thompson, James West, Fred. Bell, George Frater, James E. Knowles, Richard Rallison, Ernest Kelly, Fred. Hilley, Henry A. Meikle, John McCourt, and Jacob Stobbart, Firebosses.

This mine is situated in what is known as the Cranberry district, about 5 miles south of Nanaimo. The coal is reached by two shafts at a depth of 955 feet, from which a rock tunnel 8 by 10 feet in area is driven across the measures on a 1-per-cent. grade to the rise. The tunnel tapped the seam at a distance of 180 feet. The shaft-bottom is laid out in a most up-to-date method for handling a large output of coal. All the tracks are laid with 30-lb. rails and on a grade of 1 per cent. up from the shaft. All the main tunnels leading to this shaft are timbered with 12- by 12-inch timbers.

The seam worked in this mine is the Douglas, the thickness of which varies from 1 to 20 feet. The pitch varies from 10° to 50° and is generally dipping north or north-east. The coal is mostly of a soft nature, with a fairly strong roof.

The coal in No. 1 West heading varies in thickness from 3 to 20 feet, and is of a very good quality and fairly hard. There is a diamond-drill hole down about 1,000 feet in advance of the heading in about 10 feet of coal.

A rock tunnel 8 by 12 feet has been driven on a 1-per-cent. grade back to No. 1 hoisting-shaft and connects with the shaft 110 feet above the present shaft-bottom. This will simplify the haulage and practically make a new mine of it.

The output of this mine has been considerably increased during the year and is the second largest producer of the Western Fuel Corporation.

The ventilation of the mine is produced by a pair of 90-inch Sirocco fans, connected to a 20 by 30 engine, rope-driven. On the engine is a drive-wheel 17 feet in diameter and on the fan-shaft a drive-wheel 5 feet in diameter. These fans, running with an engine-speed of 16 revolutions, are capable of producing 140,000 cubic feet of air a minute, against a 3-inch water-gauge.

The air is carried along the Main levels on both sides of the mine and up the Main headings, and maintained by permanent stoppings of 12- by 12-inch timbers bedded in cement between the intake and return airways; these stoppings are being kept well up to the face of the workings. The Main haulage-roads and working-places are naturally damp and very little explosive gas is found in the workings.

The mechanical haulage is all carried on by means of compressed-air hoists, of which there are twelve in use. The pillars have all been extracted from the East and West levels, but

prospecting is being carried on by means of two pairs of headings about 2,500 feet apart. These headings are being driven up the full pitch of the seam and are in coal of good quality.

The Edison electric head-lamps have been installed in this mine during the year; they are finding much favour with the workmen and are proving very efficient.

The surface plant consists of four return-tubular boilers, 16 by 24 each, 208 horse-power, with a steam-pressure of 125 lb.; one hoisting-engine, 30 by 60 inches, built by Barclay & Sons, Kilmarnock, Scotland, drum 12 feet in diameter, with a 1½-inch galvanized steel-wire rope; one hoisting-engine, 24 by 48 inches, built by Barclay & Sons, Kilmarnock, drum 12 feet in diameter, with a 1½-inch galvanized steel-wire rope; each of the above engines is fitted with an automatic overwinding device. One cross-compound Canadian Rand compressor with a capacity of 25,000 cubic feet of air a minute at 90 revolutions. One Ingersoll-Rand compressor has been installed during the year with a capacity of 22,000 cubic feet of air a minute at 120 revolutions. One electric engine which supplies the light above and below ground, single engine, 14 by 14 inches, built by Robb-Armstrong, with 2 d.c. generators, 250 volts, 120 amperes.

Screens: One 3-car self-dumping tipple with shakers consisting of two screens, 1½ inches and ¾ inch respectively, picking-table, and nut and cross conveyors driven by a small compound engine.

On my last inspection of this mine I measured 50,000 cubic feet of air a minute passing into the mine, divided into two splits.

In the East side split there was 14,880 cubic feet of air a minute passing for the use of forty-eight men and six horses.

In the West side split there was 18,000 cubic feet of air a minute passing for the use of sixty-eight men and six horses.

No explosive gas found. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests made with the Burrell gas-detector were as follows: East side split showing 0.3 per cent. methane in 16,000 cubic feet of air a minute; West side split showing 0.4 per cent. methane in 20,000 cubic feet of air a minute; Main return showing 0.5 per cent. methane in 56,000 cubic feet of air a minute.

The following are the official returns from the Reserve Colliery for the year ending December 31st, 1921:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	101,351			
" export to United States	38,208			
" " other countries				
Total sales		139,559		
Used in making coke				
Used under colliery boilers, etc.	25,507			
Total for colliery use		25,507		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		165,066		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	13		12		25	
Whites—Miners	163	7.63			163	
Miners' helpers						
Labourers	69	4.81-5.35	54	4.88-5.33	123	
Mechanics and skilled labour	26	5.35-6.02	30	5.42-6.68	56	
Boys	29	2.58-4.81	15	1.74-3.89	44	
Japanese						
Chinese			31	2.34-2.99	31	
Indians	3	4.81-4.98			3	
Totals	303		142		445	

WAKESIAH MINE.

William H. Moore, Manager; Thomas Jordan, Overman; Charles F. Webber, Shiftboss; John A. Challinor, Alfred Odgers, Isaac Nash, George W. Nash, George Grey, and Samuel K. Mottishaw, Firebosses.

This mine is situated on the Western Fuel Corporation's farm, about 2 miles from Nanaimo, and is connected by railway with the Harewood branch line. Two shafts were sunk to a depth of 320 feet to the Wellington seam and a pair of levels driven in a south-westerly direction for about 1,400 feet, at which the coal-measures are tilted and thrown up at varying angles and finally cut off by what is known locally as the "Little mountain."

About 700 feet from No. 2 shaft a pair of slopes have been driven, which have cut the large fault to the south-east at about 1,400 feet. New slopes are being driven to further exploit the measures to the south and east.

The pair of headings driven towards the Old Jingle Pot mine, after encountering many disturbances, at last got into an area of good coal and is now being exploited. The coal varies a great deal in thickness—namely, from 2 to 20 feet. The floor is uniformly hard, but there is a very poor roof (except in a few small areas), which requires careful timbering. The coal itself is a very high quality, but is somewhat friable.

The contour of the field is very irregular, which makes haulage both difficult and costly. Haulage is carried on by means of five winches, driven by compressed air, supplemented by horses.

The output is now from 350 to 400 tons a day. A considerable amount of water has been encountered on the line of fault and is handled by seven pumps, six of which are run by compressed air, and the large Cameron pump at the shaft-bottom which is run by steam.

Ventilation is produced by means of a single-inlet Murphy fan, which is now driven direct, but can be changed to belt-driven in a few minutes, an auxiliary engine being kept ready for the purpose.

Ths mine is damp and free from coal-dust. Up to the present time safety-lamps of the Wolf type have been in use, but arrangements are now being made for the installation of the Edison electric head-lamps.

Another and larger compressor than the two in use has been secured, and will probably be installed early in the coming year, to provide power for further developments, larger pipe-lines being already installed for that purpose.

A new feed-water heater has been installed during the year. Coal is being hoisted from No. 2 shaft by a 14- by 16-inch first-motion engine supplied with steam at 120 lb. pressure from two boilers of 160 and 140 horse-power respectively, a $^{6}/_{19}$ 1⅛-inch plough-steel wire rope being used in hoisting. The switching-yards have been extended during the year and a new shaker-engine installed.

The general development of the mine has been retarded by the slackness of the coal trade, due largely to the increased use of fuel-oil.

As a result of the increased vigilance of the officials in the interests of "safety first," there has been no very serious accidents reported during the year, notwithstanding the frail roof and other adverse conditions.

On my last inspection of this mine I measured 26,000 cubic feet of air a minute passing into the mine, divided into two splits.

In the East side split there was 11,450 cubic feet of air a minute passing for the use of thirty-five men and three horses.

In the West side split there was 14,500 cubic feet of air a minute passing for the use of forty-eight men and seven horses.

I found a small quantity of explosive gas in face of the second place off Barton's dip, East side. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests with the Burrell gas-detector were as follows: East side split showing 0.3 per cent. methane in 12,300 cubic feet of air a minute; West side split showing 0.4 per cent. methane in 16,000 cubic feet of air a minute; Main return showing 0.5 per cent. methane in 28,300 cubic feet of air a minute.

The following are the official returns from the Wakesiah Colliery for the year ending December 31st, 1921:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	33,414			
" export to United States	12,596			
" " other countries				
Total sales		46,010		
Used in making coke				
Used under colliery boilers, etc.	20,622			
Total for colliery use		20,622		
		66,632		
Stocks on hand first of year				
" last of year	435			
Difference added to stock during year		435		
Output of colliery for year		67,067		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employd.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	8		4		12	
Whites—Miners	74	8.79			74	
Miners' helpers						
Labourers	29	4.81 - 5.35	24	4.88 - 5.33	53	
Mechanics & skilled labour.	22	5.35 - 6.02	19	5.42 - 6.68	41	
Boys	11	2.58 - 4.81	7	1.34 - 3.89	18	
Japanese						
Chinese			10	2.34 - 2.99	10	
Indians						
Totals	144		64		208	

HAREWOOD MINE.

Arthur Newbury, Manager; John White, Overman.

In this mine the most important development-work during the year was in the South-east levels, which were driven a distance of 1,000 feet, mostly in rock; also the south-west heading was completed for ventilation purposes, it being driven through to the surface. A new slope was driven down from the face of the level a distance of 100 feet, but was abandoned on account of water.

This mine was only operated about five months during the year owing to slackness in the coal trade, and most of the output came from pillar-extraction.

(For description of power-house equipment and plant at the Harewood mine, *see* Minister of Mines' Report for 1919.)

On my last inspection of this mine I measured 10,800 cubic feet of air a minute passing into the mine for the use of eight men and two horses.

No explosive gas found. Timbering and roadways were in good order and the mine entirely free from coal-dust.

Test made with the Burrell gas-detector showed no methane present in the mine-air.

This mine was partly closed down at the time of my visit, only two developing-places being worked, and on December 19th the mine was closed down indefinitely.

The following are the official returns from the Harewood Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coal.	
Tons of 2,240 lb.	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	22,502			
" export to United States	8,483			
" " other countries				
Total sales		30,985		
Used in making coke				
Used under colliery boilers, etc.	11,493			
Total for colliery use		11,493		
		42,478		
Stocks on hand first of year	7,170			
" last of year	8,434			
Difference added to stock during year		1,264		
Output of colliery for year		43,742		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employd.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	8		4		12	
Whites—Miners	75	9.06			75	
Miners' helpers						
Labourers	33	4.81 - 5.35	27	4.88 - 5.33	60	
Mechanics and skilled labour	10	5.35 - 6.02	16	5.42 - 6.68	26	
Boys	5	2.58 - 4.81	14	1.74 - 3.89	19	
Japanese						
Chinese			18	2.34 - 2.99	18	
Indians						
Totals	131		79		210	

The Nanoose-Wellington Collieries Co., Ltd.

Head Office—Wellington, B.C.

Officers.	*Address.*
Grant Waldref, President,	292 Walnut Street, St. Paul, Minn.
J. A. Coleman, Managing Director,	Seattle, Wash.
Russel H. Phinney, Secretary,	St. Paul, Minn.
M. N. Olsen, Treasurer,	Wellington, B.C.
James W. Jemson, Superintendent,	Wellington, B.C.

Value of plant, $200,000.

LANTZVILLE MINE.

James W. Jemson, Manager; Joseph Neen, Overman; John Michek, Charles Simister, Jonathan Pearson, Edward Bridge, James Handlen, Henry Carroll, George Oswald, and Hugh M. Davidson, Firebosses.

This mine is situated at Nanoose Bay, about 9½ miles north of Nanaimo, and is worked in what is known as the Old Wellington seam. The seam is reached by a shaft 8 by 16 at a depth of 133 feet. The seam varies in thickness, but is of excellent quality. There are several layers of rock between the benches of coal and overlaid by cap-rock, which also varies in thickness.

The roof is hard and dependable; therefore the prop and cap-piece system of timbering is generaly sufficient for all purposes. The pillar-and-stall system is general throughout the mine, though where the seam has become thin long-wall has been resorted to.

The larger portion of the output comes from No. 2 slope and is hauled by a compressed-air hoist, but preparations are being made to electrically operate this hoist to enable them to haul a larger trip, and thus be able to handle a larger output. A good deal of grading has been done on this slope during the last few months, which gives a more uniform grade and tends for safer haulage. Considerable improvements have been made at the top and bottom landings of No. 2 slope. At the bottom a very good track arrangement simplifies and expedites the handling of trips. At the top of the slope the track arrangement is very good and works well, which saves the services of two men and two horses in the handling of the trips.

Development-work in No. 3 slope is steadily progressing and will no doubt shortly be in the same field of coal now being mined in No. 2 slope. Therefore, having coal in two slopes, a larger increase in output is expected in the near future.

The Main level is being improved and relaid with 30-lb. steel rails. A series of brick stoppings has been built along the Main airway and partly down No. 2 slope, thereby saving considerable leakage of air. The present mine-fan is about at its limit, and steps are being taken to replace it by one of larger capacity, to be electrically driven and of the most improved type.

A small generator has been installed in the power-house to supply lights to the new houses. The houses received a coat of paint in the fall, which has greatly improved their appearance. They are exceptionally good and are equipped with every modern convenience—hot and cold water, bath, and electric light. The village overlooks the bay and a more pleasant location would be hard to find.

A "jitney" service enables the residents to go to Nanaimo at any time and the Esquimalt & Nanaimo Railway is only about a mile distant. A new school-house is to be built in the near future on a site donated by the company. The building now being used as a school-house will be used as a social hall and class-room.

During the winter months a very successful first-aid class was held and carried to a successful completion, as eighteen of the students succeeded in obtaining certificates and medallions.

This mine is fully equipped with the Wheat electric head-lamp, which is giving general satisfaction, only firebosses using the Wolf-type safety-lamp for testing purposes.

(For description of power-house equipment and plant at Lantzville mine *see* Minister of Mines' Report for 1920.)

On my last inspection of Lantzville mine in December I measured 27,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 10,000 cubic feet of air a minute passing for the use of twenty-seven men and six horses.

In No. 2 split there was 14,000 cubic feet of air a minute passing for the use of fifty-five men and four horses.

I found a small quantity of explosive gas issuing from a feeder in the floor at the face of No. 2 slope. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests made with the Burrell gas-detector showed no methane present in the mine-air.

The following are the official returns from the Lantzville Colliery for the year ending December 31st, 1921:—

Sales and Output.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	38,977			
" export to United States	5,902			
" " other countries				
Total sales		44,879		
Used in making coke				
Used under colliery boilers, etc.				
Total for colliery use		5,682		
		50,561		
Stocks on hand first of year	1,010			
" last of year	655			
Difference taken from stock during year		355		
Output of colliery for year		50,206		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Total.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	11	6.52	5	7.83	16	6.91
Whites—Miners	91	6.10			91	6.10
Miners' helpers	29	5.28			29	5.28
Labourers	52	4.97	14	4.49	66	4.79
Mechanics and skilled labour	6	5.17	18	5.18	24	5.18
Boys	8	4.13			8	4.13
Japanese			14	3.13	14	3.13
Chinese						
Indians						
Totals	197		51		248	

Name of seams or pits—Old Wellington. Coal extracted from one seam only.

Description of seams, tunnels, levels, shafts, etc., and number of same—Coal is hoisted from shaft, which acts as intake airway. Tunnel acts as fan-drift and return airway, which is also exit for men and horses. Air-current is divided into two splits.

Description and length of tramway, plant, etc.—Practically 7,000 feet of tramways. Three boilers, total horse-power 360; two compressors, total capacity 950 cubic feet a minute.

First-motion hoisting-engine. Electric power is generated by 150-kw. generator, used for all surface work, washing, screening, and operating 75-horse-power electric winch in mine. One Sturtevant fan, electrically operated, capacity 30,000 cubic feet a minute.

Granby Consolidated Mining, Smelting, and Power Co. Colliery at Cassidy.

Officers.	*Address.*
W. L. Nichols, President,	52 Broadway, New York.
J. T. Crabbs, Vice-President,	52 Broadway, New York.
Edward Everett, Secretary,	52 Wall Street, New York.
Valentine Quinn, Treasurer,	813 Birks Blds., Vancouver.
H. S. Munroe, General Manager,	Anyox, B.C.
C. M. Campbell, Superintendent,	Cassidy, B.C.

GRANBY No. 1 COLLIERY.

Charles M. Campbell, Resident Manager; James Touhey, Mine Manager; William P. Touhey, Overman; Jonathan Henney, Shiftboss; John Wright, Ernest H. Devlin, Robert Houston, Thomas Bullen, Joseph Lavin, Alex. McLachlan, Henry Mitchell, John Newman, John Bennett, Matthew Meek, Albert Radford, and Owen Dabb, Firebosses.

This mine is situated at Cassidy and is opened up in the Douglas seam, which averages 10 feet in thickness. It was acquired mainly to secure a supply of coke for the company's smelter at Anyox.

Operations at this mine were continuous throughout the year. This was due largely to the fact that steady operation of the Anyox smelter called for a regular supply of slack coal.

Improvements underground were confined chiefly to the excavation of a large sump and the installation of a Gould's triplex pump with a capacity of 300 gallons a minute when working at a head of 700 feet a minute. Air-driven pumps on lower levels pump into this central sump.

On the surface the chief improvements were in the washery. A 75-foot Dorr thickener was added to the equipment and a Smith-Vaile triplex pump with a capacity of 450 gallons a minute was installed in order to pump the clarified water from the thickener to the washery. The power-plant capacity was increased by the addition of a 360-horse-power Babcock & Wilcox boiler. An electric locomotive and six automatic side-dumping cars of the Granby type have been added to the surface equipment. This installation will handle all waste rock from the mine.

(For description of townsite, rooming-house, change-house, mine buildings, tipple and washery, and power-house equipment *see* Minister of Mines' Report for 1919.)

Underground development has been pushed ahead during the year, slopes have been driven off Nos. 5 North and South levels a distance of 800 feet, making the distance from the surface some 4,000 feet; Nos. 6 North and South levels have been turned off these slopes and are in good coal, but very friable.

The seam continues irregular in thickness, subject to rolls in the roof and floor, and a number of silted areas have been encountered.

A large number of outbursts of gas and coal have occurred in this mine during the year. The first one occurred on January 14th, 1921.

The coal displaced sometimes reaches as high as from 150 to 400 tons. The displacement of coal is not violent as a rule, simply moving the face forward 10 or 15 feet. Timbers are sometimes displaced owing to the outbursts coming more from the rib than the face and pushing the legs from under the stringers.

These outbursts give quite a little warning in the shape of cracking and "bumping" at the face before an outburst takes place. By a system of signalling and telephones in each district, and the firebosses having a small compact district due to the panel system of working, all workmen on the return side of a blow-out are warned and retire to fresh air, which is made easy by the number of splits in the air-current.

Sometimes the coal is powdered from the outburst, and as it has not been violently displaced, it would seem that the coal is already powdered before the outburst occurs; i.e., that it is in a

finely powdered state in the pocket in which the gas has been occluded. An analysis of this dust collected after an outburst showed an ash content of 40 per cent. All these outbursts have occurred below the Nos. 4 North and South levels.

All blasting is prohibited below Nos. 4 North and South levels, except where brushing either in the roof or floor is to be done, and then only under certain conditions.

There is a great deal of credit due the mine manager and his official staff for the way they have handled the large number of outbursts in this mine during the year, without any accidents occurring.

In my last inspection of Granby No. 1 mine I measured 120,000 cubic feet of air a minute passing into the mine, divided into four splits.

In No. 1 North split there was 10,000 cubic feet of air a minute passing, for the use of ten men.

In No. 2 North split there was 24,000 cubic feet of air a minute passing for the use of thirty men.

In No. 3 North split there was 26,000 cubic feet of air a minute passing for the use of thirty-seven men.

In the South side split there was 22,680 cubic feet of air a minute passing for the use of thirty men.

I found a small quantity of explosive gas in the following places: In No. 1 room off No. 2 incline, and in a crosscut off No. 3 incline, No. 4 North level, and a ⅛-inch gas-cap travelling in the air on the return side of No. 1 slope, No. 5 North level; this gas cap was due to a slight outburst of gas in this section on the day previous; also a little in Nos. 5 and 6 rooms off No. 1 slope, No. 5 South level.

Tests made with the Burrell gas-detector in this mine were as follows: Return from No. 1 North split showing 0.4 per cent. methane in 10,000 cubic feet of air a minute; return from No. 2 North split showing 0.6 per cent. methane in 26,000 cubic feet of air a minute; return from No. 3 North split showing 1 per cent. methane in 30,000 cubic feet of air a minute; South side split showing 0.7 per cent. methane in 30,000 cubic feet of air a minute; Main return showing 0.9 per cent. methane in 140,000 cubic feet of air a minute.

I regret to say that there were three fatal accidents in Granby No. 1 mine during the year—two due to falls of rock in the face and one on the haulage.

The following are the official returns for the Granby Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	125,677			
" export to United States	75,161			
" " other countries				
Total sales		200,838		
Used in making coke				
Lost in washing	57,801			
Used under colliery boilers, etc.	14,383			
Total for colliery use		72,184		
		273,022		
Stocks on hand first of year	5,437			
" last of year	1,377			
Difference taken from stock during year		4,060		
Output of colliery for year		268,962		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	16	6.75	16	6.33	32	6.54
Whites—Miners	222	8.04	.....	.....	222	8.04
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	.....	.....	31	4.65	31	4.65
Mechanics and skilled labour	106	5.47	72	5.41	178	5.44
Boys	.....	.....	13	3.03	13	3.03
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	344	7.19	132	5.11	476	6.61

Name of seams of pits—Granby Colliery No. 1, Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Douglas seam. Average dip, 20°. Seam irregular in thickness, varying from 0 to 25 feet sometimes in remarkably short distances. Seam subject to rolls, pinched and silted areas. The mine is being operated with the idea of extracting largest possible percentage of coal at minimum cost. Large and substantial pillars have been left along all main haulage-roads and permanent airways. The Main slope has been driven approximately 4,500 feet from the surface, is exceptionally well timbered, and has been driven wide enough for two tracks. Six levels have been turned to north and south off Main slope. Practically all coal extracted to date has come from development places.

Description and length of tramway, plant, etc.—Plant modern in every way. Sirocco fan, capacity 150,000 cubic feet a minute; Vulcan hoist, 18 by 36 inches, double-drum second-motion. Tipple equipped with rotary dump, Marcus screen, loading-booms, railway-cars handled with Fairmont car-retarders; washery equipped with 2-compartment jigs, capacity 80 tons an hour, seven Deister-Overstrom tables, and 75-foot Dorr thickener. Edison storage-battery electric locomotives used for underground haulage in part of mine. Boiler plant equipped with two Badenhausen boilers fired by type E mechanical stokers and one B. & W. boiler fired with Sanford-Riley mechanical stokers. Ashes flumed to dump.

King & Foster.

Head Office—Herald Building, Nanaimo, B.C.

Officers.	*Address.*
A. G. King, Jr., Partner.	Box 655, Nanaimo, B.C.
E. R. Foster, Partner.	
A. G. King, General Manager.	

THE ADIT MINE (OLD WELLINGTON COLLIERY).

These mines are operated by King & Foster, No. 1 mine being the Old Adit mine formerly operated by R. Dunsmuir & Sons and is the original Wellington seam. During the past year the coal mined in this area was taken from the outcrop lying to the west and south-east of the old adit level, and also from a few pillars. About 600 feet to the north of the portal of the old level an open-cut in soft coal has been made, but up to the present time the coal has not been of sufficient hardness to ship.

No. 2 mine, the entrance of which lies about 2,000 feet to the north of the No. 1 mine, was opened up in the early part of the year; it is in the upper seam and lies approximately 40 feet

above the Wellington seam. This mine was first opened by the late R. Dunsmuir about the year 1868, but was not worked extensively as the coal is thin; the original slope and Main level were driven very narrow, being only about 5 feet wide; the old wooden rails were found in places. At the present time the mine is worked on the long-wall system; owing to the variable thickness of the seam and the amount of dirt that has to be handled, considerable difficulty is met with in working the seam.

During the year a pit-head has been built at No. 2 mine; also a spur track on the Esquimalt & Nanaimo Railway, 1 mile from No. 2 mine, has been constructed, with a pair of loading-chutes and the necessary approach.

I inspected all accessible parts of Nos. 1 and 2 mines of this colliery in December and found timbering and roadways in good condition. No explosive gas found in the mines, which were entirely free from coal-dust.

Henry Shepherd is fireboss in No. 1 mine, where there are four men employed, and Clifford Dickenson is overman in No. 2 mine, where there are eight men employed.

The following returns show the output of the firm's mine for the year 1921:—

Sales and Output for Year.	Coal.	
(Tons of 2,240 lb.)	Tons.	Tons.
Sold for consumption in Canada	4,101	
" export to United States		
" " other countries		
Total sales		4,101
Used in making coke		
" under colliery boilers, etc.	19	
Total for colliery use		19
Stocks on hand first of year		
" last of year	100	
Difference added to stock during year		100
Output of colliery for year		4,220

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	2	4.92⅜+	2	4.92⅜+	4	4.92⅜+
Whites—Miners	10	4.25¼+			10	4.25¼+
Miners' helpers						
Labourers	5	3.71¼+	5	3.25+	10	3.25
Mechanics and skilled labour			1	4.25¼+	1	4.25¼+
Boys			2	1.75+	2	1.75
Japanese						
Chinese						
Indians						
Totals	17		10		27	

In the above average daily wage, plus (+) means high cost of living bonus in addition to rates stated.

Name of seams or pits—No. 1 or Old Adit, Wellington seam; No. 2 or Upper seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 1 Adit level on Wellington seam; No. 2 slope on the Upper seam.

Description and length of tramway, plant, etc.—Pit-head, with rock tipple and bar-screen for coal; one 5- by 7-inch hoist; one vertical boiler; one induction-fan with 5-horse-power gasolene-engine; one loading-platform with two chutes and spur track on the Esquimalt & Nanaimo Railway.

East Wellington Coal Company.

Officers.	*Address.*
H. W. Maynard, President,	Vancouver, B.C.
R. S. Jones, Treasurer,	Minneapolis, Minn.
J. S. Grant, Superintendent,	Nanaimo, B.C.

EAST WELLINGTON COLLIERY.

The East Wellington Coal Company did not operate during the year 1921.

Pacific Coast Coal Mines, Limited.

Head Office—Victoria, B.C.

Capital, $3,000,000.

Officers.	*Address.*
James Carruthers, President,	Montreal, Que.
John H. Paine, Vice-President and Managing Director,	Victoria, B.C.
D. D. Muir, Secretary-Treasurer,	Victoria, B.C.
George Wilkinson, General Superintendent,	Victoria, B.C.
William Roper, Mine Manager,	

This company did not do any work underground at either its Morden or its Suquash Collieries, employing only one man at each, practically as watchmen.

The company did, however, recover some 17,807 tons of coal from old dump by washing.

The following returns show the combined output of the company's mines for the year 1921:—

Aggregate returns from Mines of Pacific Coast Coal Mines, Limited, for 1921.

Sales and Output for Year.	Coal.		Coke.	
(Tons 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	14,205			
" export to United States	800			
" " other countries				
Total sales		15,005		
Used in making coke				
Used under colliery boilers, etc	3,516			
Total for colliery use		3,516		
		18,521		
Reclaimed from dump 17,807	19,006			
Stocks on hand first of year 1,199				
" last of year	514			
Difference taken from stock during year		18,492		
Output of colliery for year		29		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	1	8.00	3	6.00-10.00	4	
Whites—Miners						
Miners' helpers						
Labourers			4	5.85-5.50	4	
Mechanics and skilled labour			7	5.51-6.11	7	
Boys			3	3.45-4.75	3	
Japanese						
Chinese			6	2.98-3.38	6	
Indians						
Totals	1		23		24	

Dredging operation on reclamation of slack coal only.

Names of seams or pits—Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—The seam is reached by means of shafts. No. 3 shaft, which is used for hoisting, is 655 feet in depth, 10 by 16 feet in the clear; No. 4 shaft, which is used for ventilation, is 630 feet in depth, 10 by 12 feet in the clear; this air-shaft is equipped with steam-hoist and cage as the emergency outlet. the mine is opened out by slopes and levels; a pair of slopes are driven from the shaft-bottom in a north-easterly direction for approximately 2,500 feet; they are 12 feet wide. Another pair of slopes are driven in a south-easterly direction for approximately 1,600 feet; they are also 12 feet wide. Levels are driven right and left from these levels.

Description and length of tramway, plant, etc.—At this mine the plant consists of three 150-horse-power and one 100-horse-power boilers, return-tubular type; one pair of 24- by 36-inch hoisting-engines with safety overwinding device, with steam-reverse and steam-brake; two 10-foot sheaves and self-dumping cages are installed at the hoisting-shaft, and one pair of 16- by 24-inch hoisting-engines, cages, and fixtures complete at the air-shaft. In the power-house there are: One Canadian Rand cross-compound air-compressor, capacity 2,100 feet of free air a minute; one Norwalk straight-line compound air-compressor, capacity 707 feet a minute: one single straight-line Canadian Rand air-compressor, capacity 505 feet a minute: two 150-kw. electrical generators connected with 13 by 20 by 9 high-speed engines: one Sheldon ventilating mine-fan, belt-driven by a 17-20 steam-engine; a 60-horse-power electric motor is installed alongside for an emergency drive. There is a thoroughly equipped machine-shop, blacksmith-shop, and carpenter-shop, also mine-rescue station containing two sets of Gibbs rescue apparatus complete and pulmotor. In the tipple building there are two sets of Marcus screens, picking tables, etc.; the machinery being all electrically driven. A standard-gauge railway 7½ miles long, equipped with locomotives and fifty coal-cars, is used for handling coal from mine to tide-water at Boat harbour, the shipping-point, which is equipped with wharves, bunkers, washery, etc., to take care of the largest ocean-going vessels.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Capital, $15,000,000.

Officers.	*Address.*
F. Perry, President,	Montreal, Que.
H. B. Walker, Vice-President,	Montreal, Que.
H. S. Adlington, Secretary-Treasurer,	Montreal, Que.
J. M. Savage, General Manager,	Victoria, B.C.
Thos. Graham, General Superintendent,	Cumberland, B.C.

The Canadian Collieries (Dunsmuir), Limited, in 1910 acquired all the holdings of the Wellington Colliery Company, Limited, and since then has been operating the following mines:—

The Extension Colliery, in the Cranberry District (Extension); T. A. Spruston, manager.

The Comox Colliery, in the Comox District: Charles Graham, district superintendent; William Walker, John L. Williams, J. G. Quinn, managers at the several mines.

The following table shows the combined output of all this company's collieries during the past year:—

Aggregate Returns from the Canadian Collieries (D.), Ltd., Mines for Year 1921.

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	487,908			
" export to United States	77,395			
" " other countries				
Total sales		565,303		
Used in making coke				
Lost in washing	132,347			
Used under colliery boilers, etc.	35,531			
Total for colliery use		167,878		
		733,181		
Stocks on hand first of year	6,430			
" last of year	9,729			
Difference added to stock during year		3,299		
Output of collieries for year		736,480		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	88		55		143	
Whites—Miners	575				575	
Miners' helpers	11				11	
Labourers	269		153		422	
Mechanics and skilled labour	121		207		328	
Boys	10		44		54	
Japanese						
Chinese	430		272		702	
Indians						
Totals	1,504		731		2,235	

WELLINGTON-EXTENSION COLLIERY.

Thomas A. Spruston, Superintendent; James Strang, Manager, Nos. 1, 2, and 3 Mines.

This colliery is operated by the Canadian Collieries (Dunsmuir), Limited, and is composed of Nos. 1, 2, and 3 mines at Extension and No. 5 mine at South Wellington, all situated in the Cranberry district, and is connected to Ladysmith, Oyster harbour, by a railway 11 miles in extent, over which the entire output from the mines are hauled and shipped.

All the mines have worked steadily throughout the year, the coal being a very high grade of domestic fuel, being in great demand in and around the Coast cities.

The Nos. 1, 2, and 3 mines are opened up in the Wellington seam, which varies in thickness from 2 to 6 feet.

Portions of the seam are very much broken up by "folds" and "overlaps." The three mines, which were originally opened up on the outcrop of the seam, are now connected by a tunnel driven 14 by 7 in the clear on a 1-per-cent. grade and a little over a mile in length. Electric-motor haulage is maintained along the tunnel and continued into No. 2 mine a distance of 1¼ miles and half a mile in No. 3 mine. The type of electric locomotive used is the 13-ton Baldwin-Westinghouse.

(For description of power-house equipment and surface plant, tipple arrangements, wash-house, and mine-rescue station *see* Minister of Mines' Report for 1920.)

LADYSMITH.

The shipping-point for the output of this colliery is at Ladysmith, where the coal is either shipped by vessel or railway-cars by means of a transfer-barge to Mainland points. The coal-washery is also situated at this point, and consists of three washers of the following dimensions: Nos. 1 and 2, diameter 8 feet 9 inches, depth 5 feet 6 inches; No. 3, diameter 8 feet 3 inches, depth 5 feet 9 inches; computed capacity of each washer, 300 tons for twelve hours. Six compartment jigs are situated on the lower floor. Three Masco tables, 14 by 7 feet, take care of the fine coal, which produces a high-grade coal for coking purposes and foundry use. Power for the washery is supplied by a Pelton wheel which is operated from the mountain source.

A 40-kw. 240-volt Allis-Chalmers-Bullock generator supplies power to operate the Masco tables, which are driven by a 25-horse-power General Electric type H motor, and also supplies light for all purposes on the shipping-wharf, transfer-wharf, and around the plant.

There has been considerable interest taken in first-aid work at this colliery during the year: thirty-seven men have passed an examination in first-aid training and a number of them have taken training in mine-rescue work.

NO. 1 OR TUNNEL MINE, EXTENSION.

James Strang, Manager, Nos. 1, 2, and 3, Mines; William Wilson, Overman; James Glen, John Greenhorn, Walter Joyce, Thomas Wilson, William Clifford, David J. Gordon, and John Mawson, Firebosses.

This mine is the first intersected on the Main tunnel and is operating in what is known as the "Underlap" portion of the Wellington seam, which continues irregular in thickness and is subject to "steps" and "rolls" in the roof and floor of the seam, meeting with silted areas in the development of the same.

The method of mining is the long-wall system; owing to the broken and dislocated condition of the field, hand-mining is employed. During the year operations have been carried on in the No. 3 slope, in the various levels to the east and west, while the slope and counter-slope have been driven to within a workable area of the Main overlapping fault.

The Old No. 6 East section off the Main slope, which was abandoned some years ago on account of meeting with barren ground, has been opened up and driven a distance of 700 feet, passing through the barren ground into a showing of good coal, although somewhat thin. An incline has been driven up a distance of 400 feet off this level in fairly good coal.

The old Tunnel siding incline has been cleaned up and retimbered and developments commenced on the pillar-and-stall system in an area of good hard coal, averaging about 5 feet thick.

The haulage equipment consists of a 100-horse-power Ottumwa electric hoist situated at the top of the Main slope. The lower development of the No. 3 slope haulage is maintained by a 50-horse-power Ottumwa hoist driven by a Westinghouse motor.

The Edison storage-battery electric safety-lamps are in use throughout the mine. Only the firebosses use safety-lamps of the Wolf type for testing purposes. All blasting is done with permitted explosives fired by electric battery.

This mine is ventilated by a Murphy-type exhaust-fan with a capacity of 40,000 cubic feet of air a minute, against a 1.9-inch water-gauge, driven by an Allis-Chalmers-Bullock motor.

When I made my last inspection of this mine I measured 22,200 cubic feet of air a minute passing into the mine for the use of fifty-six men and five mules.

I found a small quantity of explosive gas in face of the West level skip. Timbering and roadways were in good condition and the mine entirely free from coal-dust.

Test made with the Burrell gas-detector in the return-airway showed 0.4 per cent. methane in 28,450 cubic feet of air a minute.

No. 2 Mine, Extension.

Robert L. Spruston, Overman; Joseph Watson, Robert N. Hamilton, William Cosier, Edward Heyes, William Simpson, William Bauld, John Davidson, and William Gilchrist, Firebosses.

This mine is divided into two districts—namely, No. 4 East district and the West Incline district. No. 4 East district turns off the Main tunnel at a distance of 1 mile from the entrance to the mine and is in a distance of 1¼ miles. It has been in continuous operation during the year, with the exception of the usual holidays and the Saturday afternoon shift; the miners not turning out in sufficient numbers to warrant the operation on these occasions. The method of mining is part long-wall and part pillar and stall, as the conditions and thickness of the seam permit.

The whole of the operations on the East side is concentrated on the rise side of the level and is divided into four inclines, three of which are operated by gravity. The East incline and No. 1 are worked on the pillar-and-stall method, while a portion of No. 2 incline is worked pillar and stall and a portion worked long-wall. No. 17 incline is worked exclusively on the long-wall system, the seam being very thin and undulating. The coal is gathered from all these inclines by a Baldwin-Westinghouse locomotive.

The West incline begins at a point about 500 feet to the west of the Main tunnel and parallels the old outcrop slope a distance of 2,000 feet, where the ventilating-fan is located.

Pillar-and-stall work and pillar-extraction have been the principal operations in this part of the mine during the year.

This mine, like No. 1, is equipped with the Edison storage-battery electric safety-lamps, safety-lamps of the Wolf type being used only by the firebosses for testing purposes. All blasting is done with permitted explosives fired by electric battery.

The pumping equipment of this mine consists of a 5-stage Mather & Platt turbine-pump, 375-gallons-a-minute capacity at a 250-foot head, running 1,400 r.p.m., driven by a 75-horse-power D.S.C. General Electric motor, and a 3-stage Mather & Platt pump, 275-gallons-a-minute capacity at 225-foot head, running 1,400 r.p.m.

The mine is ventilated by a Murphy fan of 40,000 cubic feet capacity, against a 1.9-inch water-gauge, and is driven by a 25-horse-power type D.L.C. General Electric motor.

When I made my last inspection of No. 2 mine I measured 33,000 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 1 East split there was 15,000 cubic feet of air a minute passing for the use of forty-six men and seven mules.

In No. 2 East split there was 8,000 cubic feet of air a minute passing for the use of twenty-two men and five mules.

In the West side split there was 10,000 cubic feet of air a minute passing for the use of twenty-two men and three mules.

No explosive gas found in this mine. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: No. 1 East split showing 0.2 per cent. methane in 16,300 cubic feet of air a minute; No. 2 East split showing 0.1 per cent. methane in 8,850 cubic feet of air a minute; West side split showing 0.3 per cent. methane in 11,300 cubic feet of air a minute; Main return airway showing 0.3 per cent. methane in 39,400 cubic feet of air a minute.

No. 3 Mine, Extension.

Thomas Strang, Overman; James P. Nimmo, Jr., David Davidson, George Smith, Daniel Campbell, and Patrick Malone, Firebosses.

This mine is reached from the end of the Main tunnel, the main haulage-road following the strike of the seam for a distance of 2,000 feet, where the slope connects with Malone's Dip section, McCoy's incline, and the Heading district; and an incline connecting the No. 4 West level and inclines to the rise side of the same. The whole operation in No. 3 mine is pillar-extraction.

The haulage equipment consists of a 50-horse-power Ottumwa electric hoist, driven by a 50-horse-power General Electric motor. The Main level haulage is operated by a Baldwin-

Westinghouse locomotive. The mine is ventilated by a Guibal exhaust-fan with a capacity of 60,000 cubic feet of air a minute, against a 1.7-inch water-gauge. This mine is also equipped with the Edison storage-battery head-lamp, with the exception of the firebosses. All blasting is done with permitted explosives fired by electric battery.

On my last inspection of this mine I measured 22,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 12,000 cubic feet of air a minute passing for the use of thirty men and seven mules.

In No. 2 split there was 9,000 cubic feet of air a minute passing for the use of twenty men and five mules.

No explosive gas found in this mine. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector were as follows: No. 1 split showing 0.3 per cent. methane in 13,500 cubic feet of air a minute; No. 2 split showing 0.2 per cent. methane in 10,000 cubic feet of air a minute; Main return showing 0.4 per cent. methane in 29,000 cubic feet of air a minute.

The following are the official returns from the Wellington-Extension Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	89,439			
" export to United States	57,204			
" " other countries				
Total sales		146,643		
Lost in washing	38,200			
Used by employees	3,899			
" under colliery boilers, etc	14,573			
Total for colliery use		56,672		
		203,315		
Stocks on hand first of year	1,458			
" last of year	3,342			
Difference added to stock during year		1,884		
Output of colliery for year		205,199		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employd.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	28		19		47	
Whites—Miners	280				280	
Miners' helpers	11				11	
Labourers	111		39		150	
Mechanics and skilled labour	40		46		86	
Boys			20		20	
Japanese						
Chinese	5		56		61	
Indians						
Totals	475		180		655	

Name of seams or pits—Wellington Extension.
Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 1, 2, and 3 mines connected by Main tunnel.

No. 5 MINE, SOUTH WELLINGTON.

Thomas A. Spruston, Manager; David Martin, Overman; Joseph Lane, James E. Parrott, James McLachlan, Adam Watson, Thomas Robson, Neil McIntyre, Robert Ewing, and William Brown, Firebosses.

This mine is situated at South Wellington, about 5 miles south of Nanaimo, alongside of the Esquimalt & Nanaimo Railway. It is operating in the Douglas seam, adjacent to the Old Alexandria mine. The coal is shipped to Ladysmith and Mainland points over the Esquimalt & Nanaimo Railway, a small spur connecting the mine operation with the main line. The mine is entered by means of a slope at the outcrop.

The Main slope is driven down a distance of 3,000 feet and is 14 by 8 in the clear, and timbered with square 12 by 12 sets, 2-foot centres, from the slope entrance for a distance of 200 feet, and from this point with round sets, 4-foot centres; the upper portion of the slope is whitewashed and electric lights strung practically all the way.

During the year no development was done on the Main slope, the last 300 feet of which was barren ground. It was found when driving the face of the slope that the roof and floor met, thereby cutting or pinching the coal out entirely. Boreholes were put in the roof and floor at various points with a small diamond-drill, without any success.

The present operations of this mine consist of No. 3 North levels which are driven to the boundary, where a Diagonal slope is turned off and driven down a distance of 2,000 feet, and, like the Main slope, this slope was driven through barren ground for a distance of 600 feet, when 7 feet of high-grade coal was struck. At the present time there are three levels in operation on the North side of the slope and four levels on the South side. The coal varies in thickness in these levels from 2 to 8 feet and is worked on the pillar-and-stall system.

The No. 6 South levels off the Main slope are in a distance of 2,803 feet in barren ground composed of blue shales. Boreholes have been put in the roof a distance of 82 feet and in the floor 100 feet, without any results.

A borehole from the surface down and a distance of 1,000 feet from the face of the levels records a showing of 11 feet of hard coal. A Diagonal slope is turned off this level at a point 700 feet from the Main slope and is down a distance of 2,000 feet in coal; levels are operating to the north and south off this slope in fluctuating ground, the coal varying in thickness from 2 to 6 feet.

The haulage equipment consists of a steam-driven hoist, 18 by 36, situated on the surface to operate the Main slope. A 100-horse-power Ottumwa electric hoist, driven by a M.S.D. General Electric motor, hauls the output from the North Diagonal slope. The South Diagonal slope is operated by a 50-horse-power compressed-air-driven hoist.

The ventilation is produced in this mine by an 8-foot Stine fan, belt-driven by a 50-horse-power type 3 Westinghouse motor, with a capacity of 80,000 cubic feet of air a minute, against a 1.5-inch water-gauge. This mine is equipped with the Edison storage-battery electric safety-lamp, the Wolf type being only used for testing purposes by the firebosses. All blasting is done with permitted explosives fired by electric battery.

(For description of power-house equipment, plant, and buildings *see* Minister of Mines' Report for 1920.)

On my last inspection of this mine I measured 40,000 cubic feet of air a minute passing into the mine, divided into two splits.

In the South side split there was 18,000 cubic feet of air a minute passing for the use of forty men.

In the North side split there was 20,000 cubic feet of air a minute passing for the use of sixty men and seven mules.

I found a small quantity of explosive gas in face of No. 1 Right counter-level off No. 6 South slope. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: North side split showing 0.4 per cent. methane in 22,000 cubic feet of air a minute; South side split showing 0.3 per cent. methane in 20,000 cubic feet of air a minute; Main return airway showing 0.4 per cent. methane in 45,000 cubic feet of air a minute.

The following are the official returns from the No. 5 South Wellington Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	59,671			
" export to United States				
" " other countries				
Total sales		59,671		
Lost in washing	26,291			
" under colliery boilers, etc	4,633			
Total for colliery use		30,924		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		90,595		

Number of Hands employed, Daily Wages paid, etc.

Character.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	8		3		11	
Whites—Miners	147				147	
Miners' helpers						
Labourers	39		11		50	
Mechanics and skilled labour	13		12		25	
Boys			5		5	
Japanese						
Chinese			21		21	
Indians						
Totals	207		52		259	

Name of seams or pits—South Wellington.

Description of seams, tunnels, levels, shafts, etc., and number of same—Slope.

COMOX COLLIERIES.

Report by Thos. R. Jackson, Inspector.

Charles Graham, District Superintendent.

These mines are situated in the Comox district, about 17 miles from Union Bay. A railway about 20 miles in length connects the various mines to a shipping-point at Union Bay, over which the whole output of coal is conveyed. The mines in operation are Nos. 4 and 5, No. 7 mine being permanently abandoned in month of September. Nos. 6 and 8 are not operating. No. 4 mine is located at the east end of Comox lake and is about 3 miles distant from the city

of Cumberland. No. 5 is situated about a mile from the city. No. 7 is located at the town of Bevan, nearly 6 miles in a northerly direction from the city of Cumberland. No. 6 mine is close to the city. No. 8 mine is about 2 miles north of Bevan.

There was no special development of note in the underground operations during the year. On the surface extensive repairs were carried out on the flume of the hydro-electric plant. The large area covered by the underground operations at No. 4 mine, Comox, has for some time been taxing the ventilation facilities at that mine. In October of the present year operations were started to install a second fan; with the new installation completed, the Nos. 1 and 2 slopes of this mine will be ventilated, each by a separate unit.

The present unit consists of a Sullivan reversible double-inlet fan having a capacity of 180,000 cubic feet a minute, against a 6-inch water-gauge. The fan is electrically driven by a 350-horse-power induction-motor, 2,200 volts, speed 250 r.p.m., and is directly connected to the fan-shaft. This fan will in future ventilate the workings of No. 2 slope, whilst the new installation will take care of the workings of No. 1 slope. The new unit is situated just west of the travelling-way, and in order to make room for the installation extensive changes were made in the railway-yard, which not only increased the capacity, but added much to the efficiency and appearance of the whole plant.

The new plant consists of a 108-inch double-inlet reversible Sirocco fan on concrete base, with half-housing in steel. The fan will be connected to the mine by a reinforced-concrete tunnel fully equipped with explosion-doors. The fan will run at 250 r.p.m. and will deliver 200,000 cubic feet of air a minute, against a 6-inch water-gauge. The primary power unit will be a 500-horse-power synchronous motor, 2,200 volts, equipped with a self-starting unit. The motor will run at 500 r.p.m., connected to the main shaft of the fan through a jack-shaft with silent chain drive in two sections, each 15 inches wide; the ratio between the motor and fan-speed being 2 to 1; the distance between centres of drives will be 106 inches.

In addition to the primary drive there will be carried as an emergency unit a 350-horse-power induction-motor, speed 250 r.p.m., which can be connected by a coupling direct to the main fan-shaft. This induction-motor is a duplicate of the motor now in use on the present ventilation units at No. 4 mine and also at Nos. 5 and 6 mines, and can in emergencies be used on any one of the three units. The power unit will be housed in a fire-proof concrete building with asbestos roofing, and in all makes one of the most complete and efficient ventilating plants in the Province.

Diamond-drilling.

During the year diamond-drilling was continuously prosecuted in the Tsable and Cumberland fields; much of the time three drills were in operation; one was withdrawn in October and transferred to the Ladysmith district.

In the Tsable River district, to the 115,220 feet of roads made to facilitate movement of drills and 15,051 feet of holes drilled during 1919 and 1920, there was added in 1921 12,900 feet of roads and 6,991.6 feet of drilling; all of this drilling gave a 2-inch core. In the Cumberland district 12,300 feet of roads were made to facilitate movement of the drills and 3,370 feet of holes drilled. This makes a total for the year in the Comox field of 25,200 feet of roads made and 10,361 feet of holes drilled.

The hydro-electric plant has been in constant operation throughout the year. The power-house has been operated satisfactorily and no repairs or improvements were required. Sufficient electricity is generated at this plant to supply motive power to all the collieries; also the wharf at Union Bay, including the lighting of this town, Courtenay, and the city of Cumberland.

First-aid and Mine-rescue Work.

I have much pleasure in reporting that active interest in first-aid and mine-rescue work continues in the district of Cumberland, a few more men having acquired the St. John Ambulance certificate. In the first-aid competition held under the auspices of St. John Ambulance Association, and open to the whole of Canada, Cumberland Colliery employees entered two teams in the contest, the result of which will not be known until some time in the beginning of the new year.

The sixth annual field-day of Vancouver Island Mine Safety Association was held on Labour Day on the athletic grounds, Cumberland. In the first-aid events Cumberland won three firsts

and a second, securing both first and second prizes in the British Columbia Department of Mines cup; also winning first in the 3-man and first in the 2-man contests.

The first prize, Department of Mines cup and gold medals, was won by No. 4 underground team of Cumberland, comprised as follows: Wm. Beveridge (captain), Jonathan Taylor, Robert Reid, Louis Francescini, and John Williams.

In the mine-rescue competition, six teams competing—namely, Nanaimo (3), Cumberland, Granby, and Ladysmith—Cumberland team carried away first prize with a perfect score of 500 points, winning the V.I.M.S.A. Shield and six Elgin watches. The team comprised Wm. Gillis (captain), Louis Francescini, Jonathan Taylor, Wm. Evans, and Arthur Watson.

Cumberland Station now consists of ten sets of approved type of Paul apparatus, the Draeger apparatus being entirely discarded. John Thomson is the supervising officer in charge of the station and does all in his power to advance the work, in addition to instructing the men in the mechanism of the machine and also lecturing to them on the subject. The machines and accessory outfit are given the best of care by the instructor. The rescue-station has always been ready to meet emergency calls, but no demands were made during the year.

Ten lessons of two hours' duration each constitute a complete course, performed in a training-gallery filled with irrespirable fumes; other conditions are made much similar in character to that in which a mine would be after a fire or explosion. The training is hard work; therefore much credit is due the men who voluntarily carry on this work.

It is rather regrettable to think that no candidates entered for a course of above work at the station this year. Different reasons might be given to answer why this is so, but the main reason is, I think, due to the laborious nature of work the candidate has to perform, which makes the course anything but popular.

At Cumberland a mine-rescue team has been practising once a week during the year, for which the company remunerates them with $2.50 each per practice. They are expected to put in four practices a month.

Safety-first Work.

George O'Brien continues to act as safety-first engineer for the company, visiting once a month all the collieries, surface and underground, and the wharves connected with these collieries in Comox and Extension districts.

It is gratifying to know that through the forces at work in this direction the results obtained are very commendable and warrants a continuation of safety-first methods for the prevention of accidents around mines.

Coal-mine regulation notices are in evidence, and safety-first notices in large letters are posted up in conspicuous places at the different collieries, printed in four languages, warning the workmen to strictly observe the rules laid down for their guidance.

At the entrance to No. 4 mine an electric safety-bell is set and so arranged that the trip of cars coming out or going in the mine causes a bell to ring, thereby warning the passer-by of approaching danger.

Inspection on Behalf of Workmen.

According to section 91, Rule 37, of the "Coal-mines Regulation Act," the workmen are entitled to appoint one or two of their number to make an inspection of all the mine once a month. This has been done regularly and no adverse report was received at this office during the year.

The company introduced an "efficiency committee" to inspect the mines as well. It consists of two miners taken from the mine employees, their wages being paid by the company.

No. 4 Mine, Comox.

William Walker, Manager; John S. Williams, Overman, No. 1 Slope; Charles Parnham, Overman, No. 2 Slope; Charles O'Brien and Norman Huby, Shiftbosses; Sam Horwood, J. Bennie, Nathaniel Bevis, Richard Hodson, Alfred Jones, Peter Myers, William Beveridge, John C. Brown, A. W. Watson, R. Barker, William Herd, Watkin Williams, Robert Reid, Thomas Lewis, D. P. Marsh, F. Hutchison, W. Whitehouse, J. Dando, Thomas Cunliffe, J. Taylor, and H. King, Firebosses.

This mine consists of two slopes with but one main entrance. There is also a manway, No. 1 slope is 7,000 feet in length, running due north. No. 2 slope is 9,000 feet long and runs

N. 45° E. These slopes diverge at a point about 75 feet from the main portal. The electric haulage-engine is so connected that trips can be run simultaneously on both slopes to a point where they converge to the main opening.

The men are conveyed from the bottom of these slopes in a man-trip at the end of each working-shift. A safety-car is connected to the rear car of the empty trip, which ensures the workmen's safety while riding up the slope.

The ventilation of this mine is produced by a Sullivan reversible fan, motor-driven, 350 horse-power, direct-coupled, running at 245 r.p.m., and capable of delivering 196,000 cubic feet of air a minute, against a water-gauge of 6 inches.

This mine has been in continuous operation during the year. Safety-lamps of the Wolf type are used by the firebosses; electric lamps of the Edison storage-battery type are used by all other employees. Where blasting is done only permitted explosives are used and these are fired by electric battery.

No. 1 Slope.

Electricity is used as the motive power to operate all pumps, winches, and coal-cutting machines. West side of No. 4 slope has a long-wall system of mining coal. Undercutting is done by a Sullivan type of coal-cutting machine. Miners digging coal by the long-wall system also work in this section. Loaders are employed to load out the machine-mined coal. Certificated miners supervise the timbering and general safety of the loaders. Pillars are also extracted from the upper side of East side section of No. 4 slope. A Sullivan coal-cutter does the undermining in some of the stalls in East side section. Seam varies from 3 to 7 feet in thickness.

Haulage from the faces is done by drivers with mules to No. 4 slope. A winch situated at top of this slope, on No. 15 West level, attends to delivery of cars. A 5½-ton Ironton storage-battery locomotive is used for hauling on above level to the bottom of Main slope, the source of supply. A recharging apparatus has been installed in above level, so that when necessary the motor can be run into the station and recharged.

During my last inspection in December I measured 32,480 cubic feet of air a minute passing into this part of the mine, divided into two splits.

In No. 1 split there was 13,000 cubic feet of air a minute passing for the use of sixty-three men and seven mules. Got a ⅜-inch gas-cap in No. 1 left place, No. 4 slant, off No. 3 West level, and a ¼-inch gas-cap in long-wall places off No. 1 West level. Section fairly free from coal-dust and general conditions fair.

In No. 2 split there was 13,000 cubic feet of air a minute passing for the use of sixty-two men and seven mules. Got a trace of gas in air off No. 20 East level pillars and a ¼-inch gas-cap in pillars off No. 2 slant, No. 1 East level. Section fairly free from coal-dust and general conditions fairly good.

No. 2 Slope.

The long-wall system of mining coal is in practice in New slope off No. 20 East level. In part of the section miners dig the coal; in the other part it is machine-mined. Extraction of pillars is conducted in the remainder of the mine, with the exception of No. 15 East level slope, the workings of which are now fairly extensive in the pillar-and-stall system.

The haulage system is much similar to that which obtains in No. 1 slope, except the motor.

During my last visit of inspection of this mine I measured 25,200 cubic feet of air a minute passing down slope at a point near No. 18 East level.

In No. 1 split there was 8,820 cubic feet of air a minute passing for the use of twenty-five men and three mules.

In No. 2 split there was 18,000 cubic feet of air a minute passing for the use of sixty-three men and eight mules. I found the ventilation and timbering fair and sections of mine fairly free from coal-dust. Got a slight gas-cap in Evans and Main slope places off No. 15 East level slope. Gas-cap of varying size in air of Nos. 16, 17, and 18 level places. No. 20 East level fenced off at door; also No. 1 level off No. 20 East slope. Got a quantity of gas at heading-face off No. 20 West level.

Owing to roof-break of six places of long-wall section off No. 20 East slope, a considerable quantity of gas was liberated, requiring No. 1 level off the slope and No. 20 East level to be fenced off.

Burrell gas-detector tests made by me in the various return airways gave the following results:—No. 1 slope: Main return, volume of air 44,600 cubic feet, 0.6 per cent. methane; No. 1 split, volume of air 23,040 cubic feet, 0.7 per cent. methane; No. 2 split, volume of air 8,000 cubic feet, 1.5 per cent methane. No. 2 slope: Main return, volume of air 56,000 cubic feet, 0.8 per cent. methane; No. 1 split, volume of air 8,820 cubic feet, 0.4 per cent. methane; No. 2 split, volume of air 35,000 cubic feet, 1.5 per cent. methane.

No. 5 Mine, Comox.

John G. Quinn, Manager; Robert Brown, Overman; Frank Crawford and Sam Jones, Shift-bosses; Duncan Thomson, Thomas Eccleston, William Devoy, Thomas Shields, John E. Spicer, William Harmison, James Monks, William J. Keenan, James Brown, Jasper Rutherford, Thomas Wilson, and A. Darbyshire, Firebosses.

The workings of this mine are reached by a shaft 280 feet deep. Electricity is used for hoisting, winch-driving pumps, coal-cutting machines, and operating Main level 6-ton motor, trolly-connected. At the bottom of No. 2 Dip slope a 5½-ton motor (Ironton) attends to the haulage on level 1,600 feet in length; the motor consists of storage-battery equipment. A recharging-station has been fitted up on the level. All the workings at present are in the Upper seam. Long-wall and pillar-and-stall systems are employed. Sullivan type of coal-cutters are principally used in stalls. Depth of undercut, 6 feet; height of seam varies from 2 feet 6 inches to 7 feet. Inclination of seam varies from horizontal to 6°. Coal-loading from the machine-cut face is done by loaders supervised by certificated miners.

In the long-wall coal getting and loading is done by certificated miners and helpers. No blasting is done without the use of cable and electric battery. Only permitted explosives are used. Electric lamps of the Edison type are used by the workmen, excepting firebosses, who use the Wolf type of safety-lamp. Part of the output is produced by extraction of pillars.

During my inspection in the month of December I measured 35,000 cubic feet of air a minute passing through the tunnel, divided into two splits.

East Split.—There was 13,000 cubic feet of air a minute passing for the use of forty men and six mules.

West Split.—There was 13,500 cubic feet of air a minute passing for the use of forty-two men and seven mules.

No. 2 Dip Section.—There was 16,500 cubic feet of air a minute passing for the use of thirty-five men and four mules. General conditions of mine good. Got a little gas at face of No. 4 West counter-level. Mine free from coal-dust.

The following represents the quantities of air passing in the different airways of No. 5 mine, also the percentages of methane in air obtained with Burrell gas-detector: East split, in 13,250 cubic feet of air a minute passing there was 0.2 per cent. methane; West split, in 8,320 cubic feet of air a minute passing there was 0.3 per cent. methane. Main return at fan, quantity of air passing a minute was 156,000 cubic feet; no methane.

No. 6 Mine, Comox.

John G. Quinn, Manager; Thomas Mordy, Overman.

There has been no coal hoisted from this mine during the year. Practically all the water made in Nos. 5 and 6 mines is hoisted from No. 6 shaft by specially constructed tanks capable of delivering 1,200 gallons of water a minute.

During my inspection in December I measured: East split, 12,000 cubic feet of air a minute passing; West split, 10,500 cubic feet of air a minute passing. Found no gas and general conditions of mine fair.

The following are the official returns for the year ending December 31st, 1921, of the aggregate output of all the Comox Collieries:—

Sales and Output for Year.	Coal.		Coke.	
Tons of 2,240 lb.	Tons.	Tons.	Tons.	Tons
Sold for consumption in Canada	338,798			
" export to United States	20,191			
Total sales		358,989		
Lost in washing	67,856			
Used by employees	6,258			
Used under colliery boilers, etc	6,168			
Total for colliery use		80,282		
Stocks on hand first of year	4,972			
" last of year	6,387			
Difference added to stock during year		1,415		
Output of collieries for year		440,686		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	52		33		85	
Whites—Miners	148				148	
Miners' helpers						
Labourers	119		103		222	
Mechanics and skilled labour	68		149		217	
Boys	10		19		29	
Japanese—Miners	66				66	
Labourers	9		1		10	
Chinese—Miners	94				94	
Labourers	256		194		450	
Totals	822		499		1,321	

Name of seams or pits—Comox mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 4, 5, and 6 shafts and Nos. 4 and 7 slopes.

COMOX INSPECTION DISTRICT.

Report by Thomas R. Jackson, Inspector.

I have the honour to submit herewith my annual report of the various coal-mines in my inspectorate for the year ending December 31st, 1921. They consist of the Western Fuel Corporation of Canada's No. 1 and Protection shafts, Nanaimo; the Canadian Collieries (Dunsmuir), Limited, Cumberland, Comox mines Nos. 4, 5, 6, and 7; and the Pacific Coast Coal Mines, Limited, Victoria, Suquash Colliery, Suquash, near Alert Bay, Vancouver island. A short description is given of each colliery, with the names of the certificated officials.

First-aid and Mine-rescue Work.

I have much pleasure in being able to report splendid progress in first-aid work. Results indicate a lessening of accidents, which must be attributed to the forces at work tending to eliminate carelessness, negligence, want of thought, and lack of appreciation of danger, due to acts and defaults of the individual. With proper instruction and education leading to observe proper precautions against accidents, a greater reduction can confidently be expected. The Western Fuel Corporation passed the year without having a fatal accident in its mines. This record was attained something like twenty years ago.

Its employees entered four teams in the All-Canada first-aid competition held under the auspices of the St. John Ambulance Association. Dr. Hodgetts, of Ottawa, was the examiner. They competed for the Montizambert, Coderre, and Wallace Nesbitt trophies. The senior results will not be known until about the end of January or during February. In the juvenile competition Nanaimo's junior team won second prize in the Wallace Nesbitt trophy. Team: Fred Gard (captain), Chas. Warton, Geo. Wallace, T. Rothery, and Dave Kenmuir.

The company sent the following first-aid team to the International first-aid competition held at St. Louis, Mo., U.S.A., where they were successful enough to tie for fourth place in the contest: Joseph Barton (captain), Charles Nicholas, James Brown, George Carson, and Joe Tyler. Sixty-four teams competed. In such a large contest, working under different conditions, Nanaimo's showing was splendid. The company paid the team's expenses in addition to reimbursing them for the loss of wages sustained by them while away.

On Labour Day, at Cumberland, in the field-meet first-aid and mine-rescue competition, conducted by the V.I.M.S.A., the following first-aid team from Nanaimo won the Coulson cup: D. Simpson (captain), Wm. Thorpe, Wm. Neave, L. Samaan, and Seth Norris. Nanaimo also secured second prize in the two-man event.

Nanaimo's first-aid ambulance class continues to be held once a week in the Odd Fellows' Hall. During 1921 it has experienced a very flourishing condition from the point of membership, having 219 seniors and 30 juniors, making a roll total of 249. The 1920–21 examinations brought forth the following results: Fifteen got first-year certificates; four got second-year vouchers; three got medallions for third year; five got labels for fourth year; and three juniors' certificates were granted for first year.

It is rather disappointing to note that no candidates appeared at the mine-rescue station to undergo a course of mine-rescue work this year. Perhaps this condition can be laid down to the fact that the work is both irksome and laborious and therefore does not induce men to undergo the test. In the mine-rescue competition held at Cumberland on Labour Day a Nanaimo team won second prize, six Elgin watches. Their score was 498 points. Team: R. Laird (captain), J. Sutherland, T. Parkinson, Francis John, A. W. Courtney, and J. Hodgson.

The mine-rescue station at Nanaimo is under the supervision of J. D. Stewart. He is assisted by George Yarrow, the Western Fuel Corporation's instructor of mine-rescue apparatus. The station is maintained in a high state of efficiency and contains the Gibbs and Paul approved type of breathing apparatus and outfit of accessories. No emergency calls were made at the rescue-station, although it is always ready to respond to such calls.

Safety-first Work.

The safety engineer of the Canadian Western Fuel Corporation mines is Arthur R. Wilson, who continues to make visits of inspection to all its collieries, surface and underground, including the wharf and machine-shops, with the object of preventing accidents.

Warning notices are placed in conspicuous places, both on the surface and underground, intended to attract the attention of the employee and warn him to beware while at work, to give the best of care and attention to his personal security from accidents.

Inspection of Mine on Behalf of Workmen.

According to section 91, rule 37, of the "Coal-mines Regulation Act," the workmen are entitled to appoint one or two of their number to make an inspection of all the mine once a month. This was done regularly and no adverse report was received at this office during the year.

Gob-fires, South Side.

The workings in No. 2 South level, which were abandoned and section sealed off last year, has now been reopened from No. 4 South level section, which lies to the dip of No. 2 South level workings. So far no evidence of heating-up has occurred and extraction of pillars continues without interruption.

In No. 2 East level section reopening was commenced a short time ago, but had to be abandoned on account of heating-up. It is proposed to re-enter the panel from another point, some time in the future, when other portions affecting the section are securely sealed off.

Pacific Coast Coal Mines, Ltd.

SUQUASH COLLIERY.

Samuel D. Wark, Manager; C. S. Congalton, Fireboss.

This colliery is situated about 12 miles north of Alert Bay, on Vancouver island. During the year the only work done underground has been repair-work, restoring ventilation, and keeping mine clear of water. On the surface considerable surveying and location-work has been done, with the object of building a railway for handling the coal from the mines to tide-water and find a suitable shipping-point for the large tonnage which will be handled at some future date from this property.

It is intended to drive another opening to tap the seam on a grade of 1 in 6 and wide enough for two tracks to accommodate an endless-rope system of haulage. Simultaneously with the driving of the slope a modern tipple and washery will be erected, also wharves, bunkers, and railway.

The development done at this mine to date is as follows: A shaft 6 by 10 feet in the clear is down 170 feet, with a midwall between. One compartment is used for hoisting and also serves as downcast; the other compartment is used for an upcast. Parallel levels are driven from the shaft-bottom—one pair N. 45° W. and the other pair S. 45° E. The North-west levels have been driven approximately 500 feet. The South-east levels have been driven a distance of 1,200 feet, and long-wall exclusively has been opened up in this level, there being twenty-six places ready for operating on this face. Two hundred feet from the shaft on the South-east levels a pair of slopes are driven N. 45° E. for a distance of 1,700 feet. On the same level, 800 feet from the shaft-bottom, another pair of slopes have been driven N. 45° E. for a distance of 750 feet.

The coal is of excellent quality; it is very hard and practically smokeless. The thickness of seam averages about 6 feet.

Permanent installations at this colliery are as follows: One Goldie-McCulloch high-pressure boiler, 100 horse-power; two Goldie-McCulloch high-pressure boilers, 150 horse-power each, have been installed and foundations are in place for two more; a pair of winding-engines, 24- by 36-inch cylinders and 9-foot drum; permanent buildings, covering all machinery installed, have been erected; also the superintendent's residence and a model bunk-house of thirty-six rooms. There are also ten four-roomed houses and ten two-roomed houses, also a large store building. Telephone communication is established with the wireless station at Alert Bay.

A generator and engine have been installed to furnish light for the buildings of the plant and dwellings. The ventilation of the mine is produced by a Sheldon fan, 4 by 2½ feet, making 125 revolutions a minute. The fan is steam-driven.

NORTHERN INSPECTION DISTRICT.

Report by Thos. J. Shenton, District Inspector.

TELKWA COLLIERY.

This mine was operated for a period of five months during the year 1920 and an output for the same period of 1,400 tons of coal was made.

Note by Provincial Mineralogist.—The Telkwa Colliery is not mentioned this year by the Inspector, but it has been learned from the Resident Mining Engineer, J. D. Galloway, that the property has not been operated.

AVELING COLLIERY.*

BETTY MINE.

This coal-mine is situated some 6 miles from the town of Telkwa up the Telkwa river, on the left bank of the river. At present the mine is under lease to J. Gillespie and J. Wilson and is managed by J. Gillespie. Before operation commenced this year at this property, which is owned by Major Aveling, of England, the Government had a bridge erected across the Telkwa river to facilitate the transportation of the coal; this was completed in the month of September, immediately after which operations began. A new camp has been built to accommodate the men engaged, and coal-bunkers to carry about 20 tons of coal have been erected at the end of the bridge and chutes arranged to permit the loading of the wagons, in which it is shipped to the railway siding at Telkwa.

Two main adits have been driven in opening up the vein, which is about 18 feet thick and fairly clear of dross. Some trouble had been encountered in opening up the seam as desired by a slope on the true dip of the vein as at first attempted, and it was thought wise to drive in the adits at right angle to dip or direction of intended slope, and after reaching the point directly in line with the slope as mentioned, to drive the slope adit outward from this point to the surface; but ere the point could be reached trouble in the vein occurred, which for the time has interfered with the plan. The low entrance at which the vein was opened in the adits mentioned was such as to be almost even with the bed of the river, and due to a recent ice-jam the ice was forced into the adit, and the track was so completely covered with ice that the haulage of the coal was interfered with, and the No. 2 adit had to be abandoned until conditions were more favourable.

The coal in quality is very good for steam purposes and fairly good for domestic purposes, and is now making a record for itself in the market at Rupert and the places along the railway. During the five months of operation the output was 800 tons and an average of six men employed. In all inspections of the operation by me I have found all conditions to favourably agree with the "Coal-mines Regulation Act."

Note by Provincial Mineralogist.—The usual and requisite official return of output for the year has not been received either through the Inspector or direct from the operators. On February 20th, in response to a telegraphic inquiry, a wire was received from J. Gillespie, the operating lessee, that he had shipped about 800 tons of coal, all of which was consumed in the Province, and such amount was entered in the statistical statement of output.

FRASER LAKE COLLIERIES, LTD.

I made a visit early in the year to the town of Endako with the intention of looking into the coal prospect of this company situated at Fort Fraser. Here I met the manager of the company, C. J. Kettyle; he advised me that at that time they had not decided to open up the property, as they were awaiting a decision of the Government *re* taking-up of coal land, and when this was decided favourably they would then be in a position to commence business, and that if this took place he would let me know, as I intended to visit them again. However, I have through reliable sources found out that during the current year nothing was done.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my annual report as Inspector of Coal-mines for the Nicola-Princeton Inspection District during the year 1921.

The companies operating during the year are as follows: The Middlesboro Collieries, Limited; Coalmont Collieries, Limited; Fleming Coal Company; Princeton Coal and Land Company; and the Chu Chua Coal Company; there being no change in the mining companies operating during the year.

Forecasting in the 1920 annual report that the Coalmont Collieries would be developed to a large producing mine during the present year I feel was quite justified, as these mines may

* *See also* Report, Resident Engineer, page 103.

now be classed among the larger producing mines of the Province. This colliery, situated on the Kettle Valley Railway, is in easy access to the Great Northern Railway, where a large amount of the output is finding a ready market in the United States.

I expect to see a more vigorous policy adopted by the Chu Chua Coal Company during the year 1922, as indications go to show that this will be extensively developed, being very accessible to the Canadian National Railway. It is at present the only producing coal-mine served by this railway in the Province and in close proximity to the city of Kamloops.

It is very gratifying to report that we have had no fatal accidents in this district during the year; while two of a rather serious character have been reported to this office. One occurred at the No. 4 mine of the Middlesboro Colliery on July 19th, when a driver, trying to pass a trip in motion to reach a mule, stumbled, fell against the cars, was carried along, with the result that he was squeezed against a post, resulting in a fractured pelvis. It is most unfortunate that drivers who, as a general rule, are very competent and active will take unnecessary chances, and indeed are frequently reckless.

A miner who was in the act of pulling down some rock at the face of his stall on a 30° pitch at the Fleming Colliery on December 29th misjudged the quantity, with the result that it rolled with the pitch of the seam, caught his leg against a post, resulting in a comminuted fracture above the ankle.

The coal-mines in the Merritt district are capable of sustaining a much larger output, but have been subject to a large amount of idle time during the year. This may be attributed to the coal companies depending to a large extent upon the Canadian Pacific Railway Company, and any slight depression on the railways appears to reflect very seriously at the mines, while the importation of fuel-oil for locomotives has a very serious effect upon the market for steam-coal.

Mine-fires.

The mines in this district have been very free from this source of trouble during the year, with the exception of the No. 1 mine of the Princeton Coal and Land Company, where there were indications of heating in the gobs. Fortunately this trouble was found to be local and the areas affected limited; they were sealed off by stoppings, which were very effective in preventing further trouble.

The coal-seams in this district are very susceptible to spontaneous combustion, and any crushed pillars or coal left in the gobs are subject to heating and require very careful attention. Unfortunately it is impossible to extract all the coal in the larger seams, where the only feasible method of work to be adopted is the panel system, with all disused and abandoned portions of the mines well sealed off by means of carefully and well-built stoppings to exclude the air.

First-aid and Mine-rescue Work.

I am pleased to report an active interest displayed in first-aid and mine-rescue work during the year. A large class has been conducted in Merritt during the year under the tuition of Dr. Tuttil, assisted by a number of the older students, all showing a great desire to acquire a knowledge of first-aid treatment to the injured; while a very successful class has been conducted at Coalmont under the able tuition of Dr. Sheffield.

This work cannot be too highly commended, and great credit is due to the members who devote their time in an earnest desire to acquire the principles of rendering first aid to the unfortunate ones who may, in following their daily avocation, require the immediate services of a trained first-aid man.

The standard of mine-rescue work has been well maintained at the Middlesboro Rescue-station during the year; while a number of the older employees have taken supplementary training, eleven employees have taken a full course in mine-rescue work and qualified for certificates of competency.

This station is maintained in a high state of efficiency, where the apparatus of the Department of Mines, together with the apparatus of the Middlesboro Collieries is under the care of Mr. Stone.

During the year the Department of Mines installed two of the latest type of Gibbs rescue apparatus, making a total of four Gibbs apparatus and six of the Draeger type, with the necessary resuscitating devices fully equipped and ready for immediate use. This is the only station in this district where the rescue apparatus is maintained in an efficient state for

immediate use, for while the different mining companies provide this apparatus, it does not receive the care and attention required and is not in a fit state for immediate use.

Edison electric safety-lamps are in use by all the workmen at the mines in this district, having been installed during the year by the Coalmont and the Chu Chua Collieries as required by 1921 amendment to section 91, Rule 8, of the "Coal-mines Regulation Act."

Samples of mine-air have been tested with the Burrell gas-detector at all the mines in operation during the year, which show the quantity of methane in the air-currents to be fairly low.

Inspection on behalf of workmen, as required by section 91, Rule 37, of the "Coal-mines Regulation Act," has been well adhered to at the larger mines of the district, the reports having always been satisfactory, while at the smaller mines no attempt has been made to comply with this rule.

Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, $1,107,700.

Officers.	*Address.*
E. W. Hamber, President,	Vancouver, B.C.
G. S. Raphael, Vice-President,	Vancouver, B.C.
Thomas Sanderson, Managing Director and Secretary,	Vancouver, B.C.
C. M. O'Brian, Treasurer,	Vancouver, B.C.
Robert Fairfoull, Mine Manager,	Middlesboro, B.C.

Value of plant, $250,000.

MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This colliery is situated at the foot of the hill, about a mile west of the Merritt Railway Station, and is served by a branch line of the Kettle Valley Railway, this branch serving both the Middlesboro and the Fleming Colliery.

No. 4 Mine.

James Fairfoull, Overman; George Hudson, William Halliman, Thomas Archibald, Louis Clark, and Robert Drybough, Firebosses.

This mine is by far the largest and most extensive of the Middlesboro Collieries and is situated at the foot of the hill on the same elevation as the tipple; it is developed by means of a large and well-kept level passing through the Nos. 4, 5, 6, 8, and 9 seams. The portions of the Nos. 4 and 5 seams that can be reached from this level have been extracted and the seams at present in operation are the Nos. 6, 8, and 9. The measures have an inclination of 30° S.W., the seams averaging from 5 to 6 feet in thickness of fairly good bituminous coal overlaid with a shale roof.

The method of work is a modification of the pillar-and-stall system, with a pair of headings driven to the full pitch of the seam to the surface croppings, which are reached at a distance of 1,000 feet from No. 4 level, for facilitating the handling of the mine-timber and ventilation purposes. All the operations are to the raise of No. 4 level, and owing to the pitch of the seams the coal is conveyed from the workings by means of chutes, where it is loaded into the mine-cars by loaders, drawn by mules to landings, and hauled to the surface by main and tail rope haulage.

From the headings, levels are driven following the strike of the seams, with the necessary crosscuts to the required distance, when the coal in the pillars is extracted, all the coal being loaded into small dump-cars, trammed by hand to the Main heading and dumped, which convey the coal to the level. All the coal is taken out of the No. 4 level from this mine, with the exception of the upper part of No. 9 seam, which is hoisted out of a slope by means of a compressed-air hoist situated at the surface and lowered over a surface incline to the tipple.

During the year No. 4 level has been extended a distance of 150 feet, being driven in the hard sand rock a little below the foot-wall of the seam and broken through into the coal as required; this system prevents any heavy timbering being required in the level, also any squeezing taking place on the level when the pillars are being extracted above.

During the year mining has chiefly consisted in the drawing of pillars, the coal being mined by hand and blasted when required, permitted explosives being used and all shots being fired by electric detonators under the supervision of certified shotfirers.

Ventilation is produced by a rope-driven 8.5 double-inlet fan connected to a 14 by 18 Ideal steam-engine, which is greatly assisted by the natural ascensional ventilation of the mine. This fan is situated near the entrance to the tunnel and is so constructed as to be reversed when required, and upon my last inspection ventilation measured showed 41,000 cubic feet of air a minute passing into this mine, divided into three splits, each having separate openings through Nos. 6, 8, and 9 seams, passing 9,100, 17,400, and 14,500 cubic feet respectively for the use of seventy-two men and three mules. Speed of fan, 120 revolutions a minute; water-gauge, 0.6 inch; barometer, 27.2 inches; thermometer, 42° F.

The brattice doors and stoppings were in good order, with the air well conducted around the working-faces, and the ventilation very good. I have not at any time been able to find any trace of explosive gas with a safety-lamp, and have made several tests with the Burrell gas-detector with the same results. The working-places are well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The roads and airways are in fairly good condition and free from dangerous accumulations of coal-dust.

No. 4 East Mine.

A. D. Allen, Overman; R. S. Brown, Fireboss.

This mine is situated a short distance to the east of the entrance to No. 4 mine and is operating No. 4 seam on the dip side of No. 4 mine, and consists of a pair of 15° slopes driven east a distance of 1,300 feet, which owing to the faulted nature of the ground have not been extended during the year. The seam in this mine is found at varying inclinations, with a large amount of overlapping, while during the year all the work has been in the lower level and mining has been to a large extent of an exploratory nature, these headings being driven to close proximity to No. 1 level, where a barrier of coal has been left and the coal on the sides of the headings extracted and the pillars drawn.

The method of haulage underground is by means of a small hoist and mules to a landing at the foot of the slope, and by a steam-driven hoist situated near the entrance to the slope for hoisting to the surface.

Ventilation is produced by a quick-running belt-driven fan driven by a small steam-engine capable of producing 40,000 cubic feet of air a minute, against a 1-inch water-gauge. During my last inspection ventilation measured showed 27,000 cubic feet of air a minute passing into this mine for the use of fourteen men and two mules. Water-gauge, 0.4 inch; barometer, 27.8 inch; thermometer, 32° F. The doors, stoppings, and brattice were in good order and the air well conducted around the face.

Only on one occasion during the year have I been able to detect explosive gas in this mine, owing to a leaking stopping which allowed the air to short-circuit, which was immediately remedied. I have made several tests with the Burrell gas-detector in this mine during the year and find the return air carrying 0.25 of 1 per cent. of methane. The working-places are well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The roads are well timbered and in fairly good condition and free from dangerous accumulations of coal-dust.

No. 4 East Prospect.

This mine consists of a small area of the No. 4 seam which has been cut off the seam by faulting, and is developed by means of slopes driven from the croppings between the No. 4 and the No. 4 East mine. These slopes strike the coal at a distance of 80 feet where the mine has been opened upon the pillar-and-stall system, and owing to the limited area of the ground mining is very restricted.

During my inspections I have always found the ventilation of this mine to be good, the roads and working-places well timbered, and a good supply of suitable timber provided for the use of the workmen.

The coal is mined by hand and very little blasting is required, which is done under the supervision of certified officials. The roads, being naturally damp, are free from coal-dust.

The coal-seam in this mine is pitching 25°, the coal being loaded into dump-cars at the face and emptied into chutes, loaded into the mine-cars on the level, and taken by mule-haulage along the level to the foot of the slope and hoisted to the surface by means of a steam-hoist.

No. 7 Mine.

Andrew McKendrick, Overman; Thomas Rowbottom, David Crawford, and Mathew McKibben, Firebosses.

This mine is situated in the Coal Gully series at an elevation of 400 feet above the tipple and the entrance to No. 4 mine, operating the No. 4 seam, which is 15 feet in thickness, dipping 25° south and overlaid by a sand-rock roof, and working the upper 10 feet of the seam.

The mine is developed by means of slopes driven to the full pitch of the seam, levels being driven from each side of the slopes; all the work being driven to the rise of the levels and during the year has consisted of drawing pillars, which have been extracted to No. 7 level.

The ventilation is produced by a small quick-running belt-driven fan of the Guibal type, driven by a compressed-air engine situated near the entrance to the mine. During my last inspection ventilation measured showed 17,100 cubic feet of air a minute passing into this mine for the use of twenty-one men. Speed of fan, 150 revolutions a minute; water-gauge, 0.3 inch; barometer, 27.76 inches; thermometer, 34° F. The doors and stoppings were in good order and the air well conducted around the working-faces.

During the year I have not been able to find any trace of explosive gas with a safety-lamp, while testing with the Burrell gas-detector shows the ventilation current to contain 0.2 of 1 per cent. of methane. All the working-places were well timbered and a good supply of suitable timber provided for the use of the workmen, while the roads were well timbered and in fairly good condition and, being naturally damp, were free from coal-dust.

Work has been continued during the year at the seams of coal cropping in Coal gully below the No. 7 seam. On the East side the No. 5 seam is being developed by means of slopes driven a distance of 250 feet, showing 5 feet of fairly good coal; while on the West side of the gully the No. 1 seam is being developed by means of levels following the strike of the seam a distance of 300 feet, the measure being somewhat faulted; the seam is 7 feet in thickness and of a soft nature, and the work of a prospective character. The coal is hauled to a siding near the entrance to No. 7 mine by means of a small compressed-air hoist.

The coal at these mines is mined by hand and blasted, when required, by explosives of the permitted class, all shots being fired by electric detonators under the supervision of competent persons appointed for the purpose. Edison electric safety-lamps are used by the workmen and safety-lamps of the Wolf pattern by the officials for inspection purposes.

The coal from No. 7 and the upper part of No. 9 mine is collected by means of air-hoists at a siding situated at the top of a surface incline, and is lowered over this incline by 2-car trips to the tipple, the cars having a capacity of 1.5 tons, where they are unloaded by means of a Phillips crossover dump; a switchback and a chain creeper haul the cars back for distribution to the different mines. The coal passes from the dump to a rotary picking-table, to a shaking screen, where it is sized and stored in the bunkers and loaded into railway-cars as required.

During the year an horizontal tandem-compound Ideal engine, 10 by 18 by 12 inches, direct-connected to a 60-cycle alternating generator, 2,300 volts, 17 amperes, running at 275 revolutions a minute, with the necessary transformer bank and panel, has been installed in the compressor-house for operating a 2-stage centrifugal motor-driven pump at the river to replace the small steam plant which provides water for the power plant and domestic purposes.

Copies of the "Coal-mines Regulation Act," special rules, with plans, are posted near the entrance to the mines.

The mine-rescue station has been well maintained during the year, where, in addition to the equipment installed, two of the latest type of Gibbs rescue apparatus have been installed by the Department of Mines during the year.

The following are the official returns from the Middlesboro Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 1,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	64,733			
" export to United States				
" " other countries				
Total sales		64,733		
Used in making coke				
Used under colliery boilers, etc.	2,689	2,689		
Total for colliery use				
Stocks on hand first of year	134			
" last of year	504			
Difference added to stock during year		370		
Output of colliery for year		67,792		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	12		5		17	
Whites—Miners	54	6.00-12.00			54	
Miners' helpers	33	5.00		4 80	33	
Labourers	44	5.00-6.00	18	5.25	62	
Mechanics and skilled labour			18	5.50-6.40	18	
Boys			8	2.40	8	
Japanese						
Chinese						
Indians						
Totals	143		49		192	

Name of seams or pits—No. 4, No. 4 East, No. 7, No. 5. East, and No. 5 West mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 4 mine, in which coal is mined from No. 6 and No. 8 seams; No. 4 East, from which No. 4 seam is mined; No. 7 mine, No. 4 seam is also mined from this mine; No. 5 East is in No. 5 seam; No. 5 West, No. 1 seam.

Description and length of tramway, plant, etc.—No. 4 seam: Access to the workings of this mine is gained by an entrance near the tipple; thence by a horizontal tunnel first driven in No. 5 seam; then by crosscutting the measures to No. 4, and again from No. 4 to No. 6 and No. 8 seams. The seams in this mine vary in thickness from 4 to 18 feet and pitch south, the angle of inclination being 30°. The coal is conveyed from the face to the mine-cars by chutes, and then hauled to the tipple by means of compressed-air hoists and ropes. Ventilation is produced by a Sheldon fan 8.5 feet in diameter, connected to an Ideal steam-engine, 14 by 18 inches, and is so arranged that the direction of the current can be changed. No. 4 East: This mine is operated by means of a slope driven east. The coal in this mine varies from 12 to 20 feet in thickness; pitches south-east, the angle of inclination being 15°. Haulage-rope is connected to steam-hoist. No. 7 mine: Operations in this mine are now

confined to the extraction of the pillars. No. 5 East: This mine is operating in No. 5 seam. A slope is now being driven east in the coal. No. 5 West: A horizontal tunnel has been driven in this mine a distance of 400 feet in the No. 1 seam, the direction being west. The coal in this mine pitches south, the angle of inclination being 15°. Haulage is by compressed-air hoist to the main landing; then by the same gravity-plane as the coal from No. 7 mine to the tipple. The main power plant is situated near the tipple, consisting of four return-tubular boilers, each 160 horse-power; Canadian Rand cross-compound compressor with a capacity of 2,000 cubic feet of free air a minute; Ideal compound engine direct-connected to a 75-kw. 2,300-volt General Electric generator; 25-kw. direct-current steam-engine set for lighting purposes.

The Fleming Coal Company, Ltd.

(FORMERLY THE INLAND COAL AND COKE COMPANY, LTD.)

Head Office—Vancouver, B.C.

Officers.	*Address.*
Joseph, Martin, President.	209 Metropolitan Bldg., Vancouver, B.C.
Joseph Graham, Managing Director,	Merritt, B.C.
Jos. Martin, Secretary-Treasurer,	209 Metropolitan Bldg., Vancouver, B.C.
A. E. Smith, Manager,	Merritt, B.C.

COAL HILL COLLIERY.

A. E. Smith, Manager.

This colliery is situated south-west of the Middlesboro Collieries, on the west side of Coal gully and about 1½ miles from the city of Merritt, and has operated in the No. 2 seam of this property during the whole of the year.

No. 2 MINE.

John T. Brown, Overman; George Maxwell, John Watterson Smith, James Sim, and Richard Dunnigan, Firebosses.

This mine is situated about 400 feet west of the entrance to the old No. 3 mine and has been developed by means of a pair of slopes driven to the full pitch of the seam a distance of 800 feet, where the boundary of this property is reached at this point. This seam has an average thickness of 6 feet, intersected by bands of rock and bone of varying thickness, and is generally overlaid with a good shale roof. The seam pitches S.W. 30° and the mine is developed by the pillar-and-stall system, with 50-foot centres, with stalls 12 feet in width. All the coal has been extracted to the east side of the slopes and the present workings consist of four levels driven west, with 200-foot lifts, and owing to the pitch of the seam all the coal is brought from the face of the stalls by means of chutes and loaded into the mine-cars on the levels.

The No. 1 level is the most extensive and has reached a distance of 1,000 feet, with twenty-one stalls driven to the full pitch of the seam to the crop-line, the whole work being followed up by the extraction of the pillars, sufficient being left to support the levels.

The method of haulage on the levels is by horse and hand; the mine-cars, having a capacity of 1 ton, are loaded at the several chutes, drawn to the landings situated near the slope, and hoisted to the surface in 4-car trips by means of main-rope haulage.

This mine is ventilated by means of a single-inlet belt-driven Aelos fan 6 feet in diameter, capable of producing 50,000 cubic feet of air a minute, against a 1-inch water-gauge, driven by a 60-horse-power steam-engine, which I have always found to be very good.

Upon my last visit of inspection the ventilation measured showed 36,000 cubic feet of air a minute passing into this mine, divided into two splits. In the lower split I found 16,000 cubic feet of air a minute passing for the use of seventeen men, and 20,000 cubic feet of air a

minute passing into the top split for the use of twenty-seven men and one horse. Water-gauge, 0.4 inch; barometer, 27.2 inches; thermometer, —4° F.

The doors, brattice, and stoppings were in good order and the air well conducted around the faces. While taking tests with the Burrell gas-detector, I failed to show any trace of methane in the air-currents. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the workmen, and the mine is very free from dangerous accumulations of coal-dust.

All the coal is mined by hand and blasted, when required, by explosives of the permitted class, all shots being fired with electric detonators under the supervision of certified shotlighters appointed for the purpose. Edison electric safety-lamps are used exclusively by the workmen and safety-lamps of the Wolf pattern by the officials for inspection purposes.

From a siding near the entrance to the mine the cars are lowered by tail-rope haulage a distance of 2,000 feet to a landing at the top of the gravity-plane, while the tail-rope hoist hauls the empties back to the mine. This gravity-plane is connected directly with the tipple, 2,000 feet in length, and is provided with a Stine wheel, 1-inch steel cable, and is operated with 6-car trips. The cars are dumped by an ordinary tip-dump, where the coal is cleaned before going into the bunkers, which have a capacity of 500 tons, the coal being drawn as required and loaded into railway-cars. This tipple is directly connected to the Kettle Valley Railway by means of a standard-gauge track 1 mile in length.

There have been no additions made at this plant during the year, with the exception that the 6-foot Aelos fan which was used for ventilating the No. 3 mine has been installed at the present mine during the early part of the year, replacing the small direct-driven Sheldon fan.

The plant consists of two Leonard-type return-boilers having a joint capacity of 80 horse-power, situated at the mine, and provides steam for the Main slope hoist at dump-heap, small tail-rope hoist, fan-engine, and lighting plant, also for heating the wash and change house. A 25-horse-power vertical boiler is situated at the tipple, which provides steam for small hoist for collecting the cars at the tipple, also pump for delivering the water from the storage-tank at the tipple to the mine; a small pumping plant is also situated at the river, which delivers the water to the storage-tank at the tipple. The surface equipment consists of machine, carpenter, car-repairing, and office buildings, with wash and change house at the mine.

Copies of the "Coal-mines Regulation Act" and special rules, with plans, are posted near the entrance to the mine, with systematic timbering rules.

The following are the official returns from the Fleming Collieries for the year ending December 31st, 1921:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Total of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	34,330			
" export to United States				
" " other countries				
Total sales		34,330		
Used in making coke,				
Used under colliery boilers, etc.	1,561			
Total for colliery use		1,561		
Stocks on hand first of year	100			
" last of year	100			
Difference { added to / taken from } stock during year				
Output of colliery for year		35,891		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	5	7.00	2	6.00	7	
Whites—Miners	38	7.50			38	
Miners' helpers	5	5.00			5	
Labourers	5	5.00	16	5.00	21	
Mechanics and skilled labour	5	5.50	7	6.00	12	
Boys						
Japanese						
Chinese						
Indians						
Totals	58		25		83	

Name of seams or pits—No. 2. The coal averages 5½ feet thick, with two ribs of rock, making the actual coal, which is bright and hard, 4½ feet thick. Owing to the bands of rock the coal is very tight in the seam, requiring much more than the usual amount of explosives. The levels have been advanced to the west from the boundary, some as much as 1,600 feet, exposing quite a large body of coal available in pillars. There is so far an entire absence of gas and very little water. The other seams, Nos. 3 and 5, were closed during the year.

Description and length of tramway, plant, etc.—The plant mainly consists of two 40-horse-power Leonard-type and two 16-horse-power Beatty boilers. The main hoist is a 60-horse-power Ottumwa hoist, and the fan is an Aelos type of 30,000 feet capacity, driven by a 60-horse-power Ideal engine. No new additions were made to the plant, but it has been maintained in a high state of repair. The bunkers are of 400-ton capacity and connected to the mine by a self-acting tramway 1,800 feet long.

Chu Chua Mine Syndicate.

Officers.	*Address.*
A. H. B. Jordan, President,	Everett, Wash.
W. H. Glass, Vice-President,	Seattle, Wash.
H. W. Schuett, Trustee,	Seattle, Wash.
Major H. S. Hodgson, Secretary-Treasurer,	616 Alaska Bldg., Seattle, Wash.
James Gray, Manager,	Chu Chua, B.C.

CHU CHUA COLLIERY.

James Gray, Manager; William Holdsworth, Fireboss.

This property is situated 55 miles north of the city of Kamloops, on the east side of the Thompson river, the present openings being about 1 mile from the Canadian National Railway, and comprises part of the foot-hills and flats situated on each side of the Newhykulston creek on the Indian reservation and adjoining the holdings of the Wigan Collieries.

Several small seams of coal of a high-grade character are to be seen outcropping on the sides of the creek, lying very conformably and dipping into the foot-hills at an angle of about 20°; and while these seams are so well defined and of a good quality, it is somewhat doubtful if it will be possible to work them with any commercial success owing to their being somewhat small and intersected with rock-bands.

Until the latter part of the present year all the work has been concentrated in the top seam, which has been developed by means of a pair of adit levels driven from the croppings at the side of the creek and following the strike of the seam for 300 feet. The coal at the face of

these levels is about 3 feet in thickness, intersected by two rock-bands 100 feet from the entrance of the Main level. Slopes were driven to the full pitch of the seam a distance of 200 feet, being of a prospective nature; while it was found that there was no material difference in the thickness of the coal, there was a marked increase in the thickness of the rock, with the result that at the latter part of the present year it was decided to take out the track, withdraw all equipment, and suspend operations.

This mine has been developed by the long-wall system, the main gates being well brushed and packed. Chutes are used for carrying the coal from the faces to the mine-cars and all waste material is used for packing the gobs. The roof overlying the coal-seam, being composed of sand rock, made conditions very favourable for this method of work. All the coal is mined with coal-cutting machines of the post-puncher type and blasted, when required, by means of permitted explosives under the supervision of certified officials appointed for the purpose.

Gray Seam.

Some 600 feet below the No. 1 mine a seam of coal has been exposed in the Newhykulston creek, which was again proved by a Calyx drill 200 feet north of the creek, when a 30° haulage-slope was driven, cutting the seam at a distance of 80 feet, where there was found to be a good seam of coal 5 feet 4 inches thick, intersected by 6 inches to 1 foot of bone coal. The slope was driven down 160 feet at the end of the year and all work concentrated at this seam. The mine-run is hauled out of the slope by means of a small compressed-air hoist, dumped into a small bunker, and hauled by teams to the railway siding, a distance of 1 mile.

The power plant consists of one 44-horse-power locomotive-type boiler; one single-stage compressor, capacity 270 cubic feet of free air a minute; one small steam electric plant for lighting purposes and battery-charging.

I have always found the general conditions of these mines to be good, well ventilated, and free from explosive gas. The roads are in good condition and the working-places well timbered, and a sufficient supply of suitable timber is provided for the use of the workmen. The mines, being naturally damp, are free from coal-dust.

As required by 1921 amendment to section 91, Rule S. twenty-five Edison electric safety-lamps have been installed at this mine for the use of the workmen, and safety-lamps of the Wolf type are used by the officials for inspection purposes.

Copies of the "Coal-mines Regulation Act" and special rules are kept posted near the entrance to the mines, also a good supply of first-aid appliances are provided.

The following are the official returns from the Chu Chua Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	1,685			
" export to United States	200			
" " other countries				
Total sales		1,885		
Used in making coke				
Used under colliery boilers, etc.	275			
Total for colliery use		275		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during the year				
Output of colliery for year		2,160		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	2	9.00	.....	.....	2	.....
Whites—Miners	8	5.75	.....	.....	8	.....
Miners' helpers	4	4.50	.....	.....	4	.....
Labourers	.....	.....	3	4.50	3	.....
Mechanics and skilled labour	.....	.....	2	5.75	2	.....
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese (cook)	.....	.....	1	4.00	1	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	14	.....	6	.....	20	.....

Name of seams or pits—No. 1 seam, now called the Thomas seam; No. 3 seam, now called the Gray seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Thomas seam: An adit level which starts from outcrop near creek, and is in a distance of 380 feet, was stopped owing to being too near the surface outcrop. Counter-level is in same distance; crosscuts 60-foot centres; seam pitches 20° to 23°. At 90 feet from surface on level a slope was started to the dip and was down a distance of 220 feet and opened out at long-wall. Coal-seam, 36 inches thick, with three bands of rock in same; sand-rock roof. Good domestic and steam coal. Gray seam: A slope was started from surface and cut into seam, which was struck in a bore-hole 40 feet from surface. Slope is now down 146 feet, from which levels are being driven right and left, and a raise is being put back to surface for ventilation. Crosscuts between levels, 60-foot centres; seam pitching 20° to 22°. Coal-seam is 60 inches thick, with three small bands of rock, and has a good roof. Good domestic and steam coal.

Description and length of tramway, plant, etc.—Coal is dumped into bunkers at No. 3 Gray seam, of 140 tons capacity, near entrance to slope; thence hauled by team a distance of half a mile to siding on Canadian National Railway for shipment. A tramway will be built during 1922; also two or three more drill-holes put down to further prove the property. The plant consists of one 44-horse-power boiler, locomotive type; one compressor, capacity 270 cubic feet of free air a minute; one steam electric plant for lighting, charging lamps, and for driving fan, with a total capacity of 75 kw. This plant will also be further increased during the year.

Coalmont Collieries, Ltd.

Head Office—Coalmont, B.C.
Capital, $3,000,000.

Officers.	*Address.*
W. J. Blake-Wilson, President,	Vancouver, B.C.
Gen. J. W. Stewart, Vice-President,	Winnipeg, Man.
A. H. Douglas, Secretary-Treasurer,	Vancouver, B.C.
Donald McLean, Manager,	Coalmont, B.C.

COALMONT COLLIERY.

Donald McLean, Manager; Alex. Bryden, Overman; John McMurtrie, Thomas Bysouth, Thomas Leeman, Robert Gourley, and John W. Sanders, Firebosses.

The Coalmont Collieries, Limited, is operating in the Coalmont field on the north-west side of the mountain, north of Granite creek, the openings of the present mines being at an elevation of 3,600 feet above sea-level and 1,600 feet above the town of Coalmont, where the tipple is situated. Until the latter part of the year 1920 the coal was hauled from the mine to the tipple over a wagon-road by 5-ton auto-trucks, by overhead tramway, constructed over the mountain, connecting the mine to the tipple.

These mines are developed by levels following the strike of the seam and are known as the Nos. 2 and 3 mines in the No. 4 seam of the series, which has an average thickness of 10 feet of clean coal immediately underlaid by a series of coal-seams of varying quality having an aggregate thickness of 80 feet.

The No. 2 levels are by far the most extensive and from which the larger portion of the present output is being extracted. Following the coal a distance of 3,250 feet from the entrance, they have not been extended during the year, standing at what is anticipated to be a 40-foot dip-fault, 200 feet from the face; a level is being driven cutting the measures to the raise, which is expected to prove this fault.

The measures are lying conformably and have an average of 29° W. All the work on No. 2 mine is driven to the rise and developed by the panel system, each panel being provided with a separate intake and return. Headings are driven to the full pitch of the seam and reach the croppings in the first panel at a distance of 600 feet from No. 2 level, with the crop-line of the seams heading away, and as a result a pair of levels known as the No. 1 levels have been driven to reach the coal to the rise, also to facilitate the handling of the timber for the use of the workmen. All the working-places are driven 12 feet wide, with the stalls following the strike of the seam, where the coal is loaded into dump-cars, trammed by hand, dumped into chutes, and conveyed by this method to No. 2 level, loaded into mine-cars, taken in trips by horse-haulage to the surface, lowered over a small gravity-plane to a landing on the same elevation and near the entrance to No. 3 mine, where all cars are collected and hauled by means of a 3-ton Jeffrey trolly-motor to the top terminal of the overhead tramway.

The No. 3 mine is situated 400 feet east of No. 2 and is developed by means of a fine 8 by 12 well-timbered tunnel known as the Wilson level, with the necessary counter, following the strike of the same coal-seam as No. 2; it has been operated during the whole of the year and extends a distance of 1,800 feet on the same elevation as the top terminal of the overhead tramway, and will eventually be the main level for developing this property.

The method of work adopted in this mine is very similar to No. 2, with the exception that the mine-track is laid in the headings, with back switches into the stalls, the mine-cars being hoisted by a small compressed-air hoist situated near the top of the heading.

All the coal is mined by hand and blasted, when required, by permitted explosives, all shots being fired by electric detonators under the supervision of certified officials appointed for the purpose.

Ventilation is produced by a 5-foot "booster" fan manufactured by the American Blower Company and is situated at entrance to fan-drift, 200 feet east of No. 2 level; it is built for producing 38,000 cubic feet of air a minute, against a 1-inch water-gauge, belt-driven by a 30-horse-power induction-motor.

During my last inspection ventilation measured showed 29,680 cubic feet of air a minute passing into this mine, divided into two splits. No. 2 mine showed 24,680 cubic feet a minute passing for the use of fifty men and seven horses, and No. 3 mine showed 5,000 cubic feet for the use of twenty-one men and one horse. Speed of fan, 1,000 revolutions a minute; water-gauge, 0.4 inch; barometer, 26 inches; thermometer, 24° F. The air was well conducted around the working-faces and the doors, stoppings, and brattice were in good order. The working-places are well timbered as required by the special rules and a good supply of suitable timber provided for the use of the workmen.

During my inspections I have not been able to find any trace of explosive with a safety-lamp, and upon examining the official report-books I fail to see where there has been any trace of explosive gas found in these mines. I have made several tests with the Burrell gas-detector during the year and have failed to find any trace of methane in the return air-currents of these mines.

The roads are naturally damp and due to the nature of the coal these mines are free from dangerous coal-dust.

Plant and Equipment.

During the year there has been a large amount of work done at these mines by way of the installation of electric equipment, which is the only power in use. The main power plant is situated at the town of Coalmont, a distance of 3 miles from the mines, and consists of two 250-horse-power water-tube boilers, with cross-drum and horizontally inclined tubes fitted with forced draught, duplicate pumps and feed-water heater attached, generating power by driving a

600-horse-power Corliss compound condensing-engine coupled direct to a G.G.E. 3-phase, 60-cycle, 480-ampere, 550-volt generator running at 150 revolutions a minute.

Transformers are situated near the power plant, where the voltage is increased to 10,000, taken over high-tension cables to transformers at the mine, where it is again reduced to 550 volts for power and 110 volts for lighting purposes.

The power plant at the mine installed during the year is as follows: 50-horse-power a.c. motor situated at the top terminal of the tramway, connected by belt and spur-gearing to a 10-foot return Fowler grip-pulley for controlling the tramway; 75-horse-power a.c. motor generating-set situated in the lamp-house and used for generating power for a 3-ton Jeffrey trolly-motor used for collecting and hauling mine-cars from the foot of the gravity-plane and No. 3 mine, and hauling the same to and from the top terminal of the tramway; 60-horse-power a.c. motor for driving belt-driven air-compressor, having a capacity of 830 cubic feet of free air a minute, running at a speed of 130 revolutions a minute, this power being used for driving the air-lifts at the tramway air-hoists and auxiliary ventilation purposes in the mine; small motor generating-set for charging 200 Edison electric-lamp batteries; 30-horse-power a.c. motor for driving the mine ventilating-fan; 30-horse-power motor at the tipple and small motor in the machine-shops. The No. 2 and No. 3 tunnels, machine-shops, mine-yard, houses, tipple, etc., have been provided with electric lights during the year.

Overhead Tramway.

During the year 1920 there was a large staff of men employed in the erection of the surface plant, overhead tramway, and the installation of machinery and equipment for producing coal on a large scale. This tramway, which was started in November, 1920, is about 2½ miles in length and is used for conveying the coal from the mine over the mountain to the tipple, the difference in elevation between the terminals being 1,600 feet. While this method of haulage has been successfully adopted at several of the metalliferous mines in the Province for the conveyance of limited quantities of high-grade ore, it was an entirely new departure around coal-mines, from which it was expected to produce coal on a large scale. At the commencement of operations it was a complete failure and incapable of sustaining the load it was required to carry owing to the wires of the carrying cables breaking, which caused the mines to work very intermittently during the early part of the year. However, by doing the necessary repairs and reducing the load in the buckets, the management was able to get along until the spring of the present year, when all work was suspended at the mine and the tramway overhauled and remodelled.

During the year the ¾-inch locked-coil stationary or carrying cable on the empty side of the tramway has been discarded and replaced by the 1⅛-inch locked-coil cable from the full side, this being again replaced by a new 1⅝-inch track-strand, reverse-lay, smooth-coil crucible-steel cable, and the ¾-inch endless or travelling cable has been replaced by a new ⅞-inch "Lang" lay steel cable. The return grip-pulley at the top terminal was fractured and was replaced by a Fowler grip-pulley. The top terminal has been remodelled by the installation of compressed-air lifts, which are used for lifting the box of the mine-car from the frame by means of carrier-arms to an overhead single rail connected to the tramway, also for lowering the empty car-box from the tramway to the car-frame. Control-house built at the top terminal, containing the necessary brake-levers, electric switches, and telephones; several of the towers adjusted and relined; large rocking-saddles at the towers installed to replace those of a fixed type.

Tensions connected to the carrying cables replaced by large blocks and anchors; the overhead rail connected with the tramway at "anchor hill" largely extended, with the bottom terminal at the tipple strengthened by means of reinforced concrete. Perhaps the most interesting feature of the tramway is the control, for while it is equipped with friction-brakes, they are very seldom required, being controlled by means of a 50-horse-power a.c. constant-speed motor situated at the top terminal of the tramway, running at 640 revolutions a minute, connected by belt and spur-gearing to the return grip-pulley, keeping the tramway running at a constant speed, generating power when required, and acting as a brake when the tramway is generating power by destroying the synchronity of the electric field and forcing a current against the voltage of the system.

The buckets have a capacity of 1 ton and are attached to the travelling rope by means of grips. The lower terminal at the tipple is provided with automatic detachers and attachers, the buckets running by gravity to the dump and emptied into a chute connected to a Marcus shaking

screen, and is at present provided for making three classes of coal; each bucket makes a return journey in 1¼ hours, with a total of eighty buckets on the tramway, and delivering at the tipple approximately 1 ton a minute. Since the repairs and changes have been made it is very pleasing to report that the tramway is giving every satisfaction and is very free from trouble.

This tramway is only operated on the one shift, and while there appears to be an almost unlimited demand for this coal, there is at present a limited accommodation for employees.

ACCOMMODATION FOR EMPLOYEES.

The accommodation for employees at the town of Coalmont is the same as reported during the year 1920, which consists of about twenty cottages, the property of the Coal Company, with a number of private cottages and a good hotel situated on the townsite.

The large and commodious rooming-house at the mine was completed during the beginning of the year and furnished to accommodate seventy-two men; this building is steam-heated, electric-lighted, and all bedding and furnishings are provided by the company to ensure cleanliness and comfort for the employees. This rooming-house is connected by a covered passage-way to a large combined change and wash house, steam-heated, provided with shower-baths, wash-basins, lockers, and large lavatory, which includes every convenience.

A large dining-room, well provided, comfortably furnished, well equipped, electric-lighted, steam-heated, with the necessary stores, is situated near the rooming-house, with accommodation for about 100 men.

During the year three officials' houses, doctor's office, and a number of small houses have been erected at the mine. The doctor's office is supplied with hot and cold water and well provided, with the doctor being in daily attendance at the mine.

The rooming-house, dining-room, and the wash-room are heated by a 42-horse-power Jencks tubular boiler situated at the mine, providing all the hot water necessary, while a water system with the necessary hydrants and hoses have been installed during the year for domestic and fire-protection.

As required by 1921 amendment to section 91, Rule 8, of the "Coal-mines Regulation Act," a modern lamp-house has been erected near the entrance to No. 3 mine, with the necessary repair-benches, charging-racks, small motor generating-set, with the installation of 200 Edison electric safety-lamps for the use of the workmen; while copies of the "Coal-mines Regulation Act," special rules, with systematic timbering rules and plans of mines, are kept posted near the entrance to the mines.

The following are the official returns from the Coalmont Colliery for the year ending December 31st, 1921:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	32,264			
" export to United States	27,445			
" " other countries				
Total sales		59,709		
Used in making coke				
" under colliery boilers, etc	3,635			
Total for colliery use		3,635		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		63,344		

We load direct from mine to cars by means of an aerial tramway and have no storage facilities.

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	6	6.50	7	6.00	13	
Whites—Miners	50	7.50			50	
Miners' helpers						
Labourers	22	4.90	22	4.75	44	
Mechanics and skilled labour			6	5.87	6	
Boys	2	2.50	1	2.50	3	
Japanese						
Chinese			1	2.50	1	
Indians						
Totals	80		37		117	

Name of seams or pits—Nos. 2 and 3 mines in No. 1 seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Seam now being mined, average thickness 10 feet. No. 1 level driven 650 feet; No. 2 level driven 3,200 feet; No. 3 level driven 2,820 feet: all in same seam. Seam being mined, fourth seam under 12 feet of sandstone. Aggregation of seams immediately under seam mined average 80 feet in thickness. Total aggregation, 160 feet thick. Seam 300 feet below above aggregation 12 feet in thickness. All seams conformable.

Description and length of tramway, plant, etc.—Tram in No. 2 level, 3,400 feet; tram in No. 3 level, 2,820 feet; tram in yards, 2,620 feet; aerial tram, 15,110 feet. Plant at mine: One upright tubular boiler, 22 horse-power; two Jencks tubular boilers, 42 horse-power each; one induction-motor, 200 horse-power; one induction-motor, 50 horse-power; one induction-motor, 30 horse-power; one compressor, 1,055 cubic feet; one compressor, 500 cubic feet. At Coalmont: Two water-tube boilers, 250 horse-power each; one Corliss cross-compound condensing-engine, 600 horse-power; one generator, C.G.E., 3-phase, 60-cycle, 550 volts, 480 amperes, 150 r.p.m. Tipple with Marcus screen.

Princeton Coal and Land Company, Ltd.

Head Office—15 Great St. Helens, London, E.C.

Capital, $1,000,000.

Officers.	*Address.*
A. St. George Hamersley, Chairman,	London, England.
E. S. Neave, Secretary,	London, England.
Ernest Waterman, General Manager,	Princeton, B.C.
Francis Glover, Manager,	Princeton, B.C.

Value of plant, $77,000.

PRINCETON COLLIERY.

Francis Glover, Manager.

This colliery is situated near the town of Princeton, on the right bank of the Similkameen river near its junction with the Tulameen, and is situated in the Similkameen Mining Division.

PRINCETON NO. 1 MINE.

William James, Overman; John Liddle, and George Walker, Firebosses.

This mine is developed by means of a pair of 12-per-cent. slopes driven to the full pitch of the seam and reaching the coal at a distance of 200 feet from the portal of the slopes. The

coal-seam averages 20 feet in thickness, the lower portion being somewhat dirty; the work is generally confined to the upper 10 feet of the seam, all work at present being confined to the extraction of pillars.

As stated in the 1920 Report, diagonal slopes had been started from the Main slope 750 feet from the portal, driven 15° west of the Main slopes, driven in a solid section of the coal which had been cut off the workings of the mine by faulting, when it was intended to extend these slopes below the present workings of the mine and again open up the mine in the lower measures by the panel system of working.

However, after being driven a distance of 500 feet there were indications of heating in the old gobs near the entrance to these slopes, and after spending some time trying to locate the source of trouble it was found to be very local, when this area was sealed off with stoppings well covered with gunite, which proved to be very effective in preventing further trouble; it being decided to extract all the coal that could be recovered on the sides of these slopes and abandon the same, and develop this seam from a new opening at some future time.

This coal is mined by coal-cutting machines of the post-puncher type, with very little blasting required, it being of a lignitic character and generally used for domestic purposes, the object being to recover it in as large a size as possible.

The coal-seam in No. 1 mine is very susceptible to spontaneous combustion and any crushed coal or small pillars left in the gob will very quickly spring into activity, providing it is allowed the necessary air to support combustion, and one has only to note the refuse and dump heaps situated at the surface to acquire a knowledge of the care and attention needed in the mine to guard against this source of danger. The chief object in view should be to obtain a system of ventilation and a mode of working that would tend to eliminate this source of trouble by adopting the panel system of working the coal, and all disused or abandoned portions of the mine sealed off with good substantial stoppings, so as to prevent any air circulating through any inaccessible roads.

Ventilation is produced by means of a small fan of the Guibal type, belt-driven by a small steam-engine, and upon my last inspection was producing 5,000 cubic feet of air a minute for the use of sixteen men. Water-gauge, 0.1 inch; barometer, 27.9 inches; thermometer, —0° F.

The method of haulage adopted at this mine is very simple, all the cars being brought by hand to the Main slope, all switching, collecting, and hoisting to the surface by means of a steam-hoist situated at the tipple.

During my inspections I have generally found this mine to be very free from explosive gas, and only on one occasion have I been able to find a gas-cap, and making a test with the Burrell gas-detector showed the return air to contain 0.15 of 1 per cent. of CH_4.

The roads were in fairly good condition and, being naturally wet, were free from coal-dust. The working-places were well timbered as required by the special rules, and a sufficient supply of suitable timber provided for the use of the workmen. Blasting, when required, is carried out at this mine under the supervision of certified officials as provided for by the "Coal-mines Regulation Act." Edison electric lamps are used exclusively by the workmen, while safety-lamps of the Wolf pattern are used by the officials for inspection purposes.

Gem Seam.

Hugh Gillespie, Fireboss.

During the year preparation is being made to open the Gem seam, which is lying above the No. 1 seam and is being opened up from the cropping by means of a 6 by 8 well-timbered slope which has been extended for a distance of 100 feet, showing 4 feet of clean coal overlaid by a sand-rock roof, with 4 inches of mining-dirt in the floor.

This mine is situated 4,300 feet south of the No. 1 mine and about 2,000 feet south-east of the Princeton Station, and is served by the branch line of the Kettle Valley Railway which was extended to Copper mountain, which runs through the property.

The surface equipment consists of a tipple provided with a rotary tipple-dump, where the coal is dumped upon a stationary 2-inch bar-screen, where the large coal is cleaned and loaded into the cars. The coal falls through the bars to a hanging shaking screen, 12 feet in length and 6 feet in width, with ¾-inch mesh, and is collected by means of belt-conveyors, taken to the various chutes, and loaded into the cars.

The power plant consists of three return-tubular boilers with an aggregate capacity of 200 horse-power; Canadian Rand compressor having a capacity of 750 cubic feet of free air a minute, which is used for driving the power mining-machines, pumps, and small hoists in the mine; 25-horse-power mine steam-hoist situated at the tipple.

Well-equipped machine-shop, car-repairing and carpenter shop, wash-house, and lamp-house are well maintained, while a 30,000-gallon water-tank is provided for storage and fire-protection purposes.

Copies of the "Coal-mines Regulation Act," special rules, systematic timbering orders, and plans of the mine are kept posted near the entrance to the mine.

The following are the official returns from the Princeton Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	9,804			
" export to United States	952			
" " other countries				
Total sales		10,756		
Used in making coke				
Used under colliery boilers, etc	2,925			
Total for colliery use		2,925		
Stocks on hand first of year	33			
" last of year	318			
Difference added to stock during year		285		
Output of colliery for year (not including waste, 1,118 tons—not provided for in this return)		13,966		

Number of Hands employed, Daily Wages paid, etc.

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	4		2	4.41-7.14	6	
Whites—Miners	14	6.00-9.00			14	
Miners' helpers						
Labourers	18	5.00-4.50	8	3.85-4.00	26	
Mechanics and skilled labour			7	4.80	7	
Boys						
Japanese						
Chinese						
Indians						
Totals	36		17		53	

Name of seams or pits—Same as last year, with the addition of prospecting-work on the Gem Bed seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Same as last year, with the addition of shaker screens and picking-belt conveyor. The new slopes have been stopped and the coal is being pillared.

Description and length of tramway, plant, etc. The Gem Bed seam is opening up very promisingly so far and appears to average about 4 feet from roof to floor of clean coal, with a sandstone roof approximately 70 feet thick. The coal is of very high-grade quality, sub-bituminous.

EAST KOOTENAY INSPECTION DISTRICT.

Report of Robert Strachan, Senior Inspector.

I have the honour to submit the annual report covering the coal-mines in operation during the year 1921 in the East Kootenay Inspection District.

This district is directly in charge of John McDonald, with office in Fernie, and attached to this report is his description of the various mines in operation and the conditions which prevail in and around them.

The collieries in operation were the same as in the previous year—namely, Coal Creek, Michel, and Corbin; the first two owned by the Crow's Nest Pass Coal Company, Limited, of Fernie; the latter by the Corbin Coal and Coke Company, of Spokane, U.S.A.

No attempt was made to reopen either the Hosmer Colliery at Hosmer, owned by the Canadian Pacific Railway Company's Natural Resources Department, closed down in 1914, or the Morrissey Colliery, owned by the Crow's Nest Pass Coal Company, closed down in 1909.

Seven mines were in operation at Coal Creek, three at Michel, and two at Corbin during the entire year. At the latter colliery no coal was produced from the No. 3 mine or open-cut during the year, but development was pushed on the No. 6 mine, which proved the existence of a seam of coal 420 feet in thickness.

Relations between employees and employers have been very good during the year under the agreement entered into March 31st, 1920, which expires March 31st, 1922. Provision is made in the agreement that the parties will meet in conference thirty days prior to the expiration of the agreement to discuss a renewal thereof.

While there has been no loss of work due to labour troubles, lack of demand for coal has caused a great deal of loss of work throughout the year, amounting to: Coal Creek, 96 days; Michel, 83 days; Corbin, 124 days; or a total of 303 days for the district during the year.

Accidents.

Nine accidents were reported to this office, as provided for by the "Coal-mines Regulation Act," involving death or serious disability to the same number of workmen.

Many slight accidents occurred, but were not reported to this office, owing to the Act requiring only serious or fatal accidents to be reported, except in the event of an explosion of either powder, boiler, or mine, and it is very pleasing to be able to report that no accident of this kind occurred during the year.

The accidents according to the collieries were: Coal Creek, 6, including 2 fatal; Michel, 3; and Corbin, 2. Six of these occurred on or connected with haulage, two were due to falls of coal at the working-face, and one to fall of rock on the haulage-road.

In the case of Coal Creek the two fatal accidents occurred at the same mine, No. 2, the first being to a rope-rider while riding on the rear end of a loaded trip on its way towards the outside of the mine. The overhead timbers must have been settling down and grazed the top of the loaded trip; one of the timbers or a piece of lagging must have got between the last two cars, which pulled it out, allowing the roof to cave, sweeping the rope-rider off the end of the trip, burying him, while the trip continued to the foot of the incline. Following this accident an investigation was held by W. H. Wall, at which evidence was given and a special report made to the Hon. the Minister of Mines.

The second fatal accident occurred to a miner while on his way from his working-place to the lamp-room. He had reached the mine portal, when seven cars which had become detached from a trip, which was being pushed out by a compressed-air locomotive, overcame him, knocking him down, with fatal results.

Adequate manholes are provided on this haulage-road, which has a very easy grade, but sometimes workmen, in their anxiety to get outside, take unnecessary chances in trying to keep ahead of a trip of cars, and I consider provision should be made either to provide a travelling-way entirely apart from the haulage-roads, or have some means of preventing workmen travelling while the haulage is in motion.

The other two non-fatal accidents at Coal Creek were the case of a timberman's helper, while riding a rope during repair-work, jumping off a trip while in motion, being flung against the side of the roadway, and a driver being caught between a car and the sides. In the latter

case there was plenty of room between the side of the car and the roadway, but the empty car had got off the track, and while the driver was lifting it the horse started up, jamming him between the car and the side.

No accidents were reported from Coal Creek as occurring at the coal-face, which, I feel, reflects the vigilance of both the workmen and the officials.

At Michel two accidents occurred at the working-face, due to falls of coal, and should emphasize the necessity of greater care, both by the workmen and the officials. The other accident occurred to the driver of the locomotive outside the mine, who fell off while it was in motion.

At Corbin the two accidents reported both occurred outside the mine; one to a workman while trying to tip a dump-car with a lever, the car after being almost dumped swinging back, striking the lever and in this way dislocating his collar-bone; the second was to the driver on the tipple, whose foot got entangled with the horse's reins, pulling him off the front of the car, allowing it to run partially over him.

The causes of the accidents were as follows:—

Colliery.	Haulage.	Fall of Coal at Working-face.	Fall of Rock.
Coal Creek	3	..	1
Michel	1	2	..
Corbin	2	..	..

Four of the accidents, including one of the fatal, occurred outside the mine, and five, including one fatal, inside the mine. The accidents according to occupation are: Miners, 3; timberman, 1; drivers, 2; rope-rider, 1; motorman, 1; and trackman, 1.

The rate per thousand workmen employed is 1.13, and as compared with the previous year shows a decrease of 0.76.

The amount of coal produced for each man killed is 379.877 long tons, as compared with 282.463 for the previous year.

Coroners' inquests were held in the case of both fatal accidents, at which the Department of Mines was represented by the Inspector, and we wish to extend our thanks to the Coroner for allowing us every facility to clear up the cause of the accident.

Ventilation.

The general condition of the mines with respect to ventilation is dealt with in the report attached by John McDonald and reflects much better conditions than have prevailed heretofore. As in previous years, advantage was taken of the kind offer of the Dominion Department of Mines to analyse samples of the air from the various mines, and 247 samples were taken, of which 41, or 16.6 per cent., were lost, due either to leakage or breakage.

A new ventilating-fan is being installed at the No. 1 East mine, Coal Creek, with a capacity of about 300,000 cubic feet of air a minute; the work is completed with the exception of the driving machinery. Whether it will be driven by electric power or steam has not yet been determined, for with the introduction of hydro-electric power from the works of the Alberta and British Columbia Company at Bull river the tendency will be to use electric power instead of steam.

Coal-dust.

During the year the mines have been kept fairly good with respect to the treatment of coal-dust, water being used to a great extent for this purpose. As I mentioned in my last year's report, some method of sampling the dust at regular intervals and different portions of the mine, with the resultant analysis posted at the entrance to the mine, would assist in keeping the dangers from this source well to the front.

Bumps and Blow-outs.

No fatal or serious accidents have been reported from either of these sources during the year. Small bumps have been reported occasionally, but apart from destroying or wrecking a few hundred feet of roadway, nothing more serious has been reported.

These have been reported generally from the Main Tunnel district of No. 1 East and may have been due to a fault which has been encountered there; this fault has a displacement of about 40 feet and the sides are very well defined. Work is now proceeding to penetrate through the fault and probably some change in the conditions may be encountered.

The blow-outs have mostly been found in the working-faces of the No. 14 East slope of this mine (No. 1 East, Coal Creek) and have neither been so violent nor extensive as experienced in previous years. The work of drilling the working-faces to reduce the effect of these blow-outs still continues, and to show the perversity of human nature, the workmen sometimes complain of this work owing to the tendency to make the coal harder to mine, even although, as in one case lately, a blow-out occurred, displacing between 10 and 20 tons of coal, besides giving off a very large volume of methane.

Inspection on Behalf of the Workmen.

This inspection, as provided for by section 91, Rule 37, of the "Coal-mines Regulation Act," has been carried out regularly at all the collieries, and no occasion has arisen when the inspecting committee has deemed it necessary to make any complaints as to the conditions existing to this office as required by the same section and rule.

This work of inspection has been of great assistance to us in maintaining the conditions in the mines fairly good, and we are very much indebted to the workmen for the interest taken and the regularity of the inspection.

Searches of the workmen for matches, pipes, etc., contrary to the Act, have been carried out regularly at all the mines, and it is very pleasing to report that only in one case were matches found.

A list of the prosecutions is attached, and shows one case under the "Coal-mines Regulation Act" for having matches in possession contrary to section 91, Rule 9; one case for riding on a trip contrary to Special Rule No. 63; and five cases for failing to use sprags for the undermined coal, making a total of seven cases.

I have again to mention the inadequate penalties inflicted, especially in cases such as having matches in the mine, and when we consider the amount of damage and danger to life involved in mines with such possibilities of gas-outflow, a penalty of $5 would almost seem an encouragement than a detriment. It may be charitable to think that such penalties are due to the ignorance of the dangers of mining, but we cannot overlook the fact that hundreds of men's lives may hinge on a single match in the hands of an ignorant or careless workman.

Crow's Nest Pass Coal Company, Ltd.

Capital, $3,500,000.

Officers.	*Address.*
W. R. Wilson, President,	Fernie, B.C.
E. C. Whitney, Vice-President,	Ottawa, Ont.
R. M. Young, Secretary,	Fernie, B.C.
A. Klaner, Treasurer,	Fernie, B.C.
W. R. Wilson, General Manager,	Fernie, B.C.
Bernard Caulfield, Colliery Manager, Coal Creek Collieries,	Fernie, B.C.
Thomas H. Williams, Colliery Manager, Michel Collieries,	Michel, B.C.

The above company is now operating the following extensive collieries on the western slope of the Rocky mountains in the East Kootenay District, namely:—

Coal Creek Colliery, situated on Coal creek, about 5 miles from the town of Fernie, on a branch railway to the mines, connected at Fernie with the tracks of the Canadian Pacific Railway and also those of the Great Northern Railway.

Michel Colliery, situated on both sides of Michel creek, on the line of the Canadian Pacific Railway, being 23 miles in a north-easterly direction from Fernie.

The amount and disposition of this combined output of the company's collieries is fully shown in the following table:—

COMBINED RETURNS FROM CROW'S NEST PASS COAL CO.'S MINES FOR YEAR 1921.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lbs.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	85,467			
" export to United States	454,299			
" " other countries				
Total sales		539,766		
Lost in washing				
Used in making coke	85,644			
Used under colliery boilers, etc	56,004			
Total for colliery use		141,648		
Stocks on hand first of year	120			
" last of year	10,530			
Difference added to stock during year		10,410		
Output of colliery for year		691,824		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	ABOVE GROUND.		UNDERGROUND.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	44		23		67	
Whites—Miners	627				627	
Miners' helpers						
Labourers	386		250		250	
Mechanics and skilled labour	48		216		264	
Boys	12		17		29	
Japanese						
Chinese			6		6	
Indians						
Totals	1,117		512		1,629	

COAL CREEK COLLIERY.

Bernard Caufield, Manager; Jas. Taylor, Assistant Manager.

This colliery is situated about 5 miles from Fernie, seven mines being operated, three on the north side and four on the south side of the Coal Creek. Connection is made at the town of Fernie with the Canadian Pacific and Great Northern Railways by the Morrissey, Fernie & Michel Railway. In addition to the coal-train, a regular passenger service is maintained for the convenience of the workmen, the majority of whom live in Fernie, while a large number of dwellings are provided at Coal Creek for those who prefer living near the works.

Nos. 1 East, 1 South, and 1 North mines are mining the No. 1 seam at different points, 10 feet of the upper portion being extracted in the first operation; Nos. 2, 3, and 9 mines are mining the No. 2 seam, which has an average thickness of 6 feet; B North is operating the

B seam, which has an average thickness of 5 feet, with 4 feet of inferior coal for a floor, part of this being taken up to allow of sufficient height for haulage. The inclination of the seams average about 12°, dipping to the east.

The tipple at this colliery is of steel construction, has a total length of 840 feet, extending right across the valley, and receives coal on both sides; it is equipped with two independent electrically driven circular dumps, which deliver the coal to feed-conveyors that supply the shaking screens. These separate the slack from the lump coal, the latter being delivered to the picking-tables, where all foreign material is picked out before it is finally loaded into the railway-cars; provision is made for loading into either open or box cars, two Smith hydraulic box-car loaders being provided for dealing with the latter.

The main power plant is situated on the north side of the valley and consists of fourteen boilers, with an auxiliary plant of five boilers on the south side; the total capacity of the whole plant is approximately 3,250 horse-power. Power to drive the compressed-air hoists and pumps underground is supplied by three compressors having a total capacity of 6,000 cubic feet of free air a minute, compressing it to 80 lb. to the square inch. There is also a Canadian Rand (high-pressure) compressor having a total capacity of 1,346 cubic feet of free air a minute, compressing it to 900 lb. to the square inch, which provides the power to drive the air-locomotives.

The electric plant consists of three generators with a capacity of 680 amperes at 250 volts, driven by two Robb-Armstrong engines, and provides the power to drive the fans at Nos. 1 South, 1 North, and B North mines, the motors on the tipple, as well as the electric light for the mine buildings, yards, and houses at Coal Creek.

A well-equipped lamp-room is located in a central position at the mines, where all safety-lamps are cleaned and repaired; this building is fully provided with all necessary appliances for keeping the lamps in a good state of repair. A large wash and change room is situated convenient to the mines, where the workmen can have a locker for a small monthly payment; these lockers are of steel construction, and the wash-house is under the charge of a workman whose duty it is to keep it in a clean and sanitary condition, the workmen providing their own soap and towel.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at the colliery.

Following is a brief description of the mines and the conditions prevailing therein throughout the year:—

No. 1 East Mine.

J. Caufield, Overman; H. Dunlap, J. Duncan, J. Maltman, and T. Reid, Firebosses.

This mine is situated to the east of the tipple, the seam being reached by a drift at a distance of 215 feet from the entrance. The method of work is a modification of pillar and stall, levels being driven in pairs, each pair being separated by 150-foot pillars; after the first three sets of levels are set away the size of pillar is increased to 200 feet.

Ventilation is produced by a fan of the Wilson type, running at a speed of 148 revolutions a minute, which produces an average quantity of 120,000 cubic feet of air a minute, under a water-gauge of 3.5 inches.

A new fan has been installed during the year; the work of clearing the ground was commenced during the latter part of May, and, with the exception of the installation of the driving-motor, was completed at the end of November. The fan is an 11-foot-diameter Sirocco, calculated to deliver 300,000 cubic feet of air a minute; the fan-house and engine-room is a fire-proof building, built entirely of concrete, and measures 66 feet 9 inches in length to the centre of the shaft, is 43 feet 6 inches in width, being connected to the return airways by a shaft 60 feet deep and 16 feet in diameter.

This mine is ventilated by four splits; the quantities passing in each at the last inspection measured as follows:—North split, 180 by 80: 14,400 cubic feet of air a minute for the use of sixteen men and two horses. Second South, 370 by 70: 25,900 cubic feet of air a minute for the use of seventeen men and three horses; Burrell gas-detector, 1.1 per cent. methane. First South, 190 by 80: 15,200 cubic feet of air a minute for the use of twenty men and three horses; B.G.D., 0.7 per cent. methane. West split, 420 by 60: 25,200 cubic feet of air a minute for the use of thirty-three men and five horses; B.G.D. (not acting). Main return, 1,160 by 104: 120,640 cubic feet of air a minute for the use of eighty-six men and thirteen horses.

Throughout the year explosive gas has been found fifteen times in the course of inspection, mostly in cavities in the roof above the timbers, the soft nature of the roof making it a hard task to prevent entirely the formation of such. The percentage of methane present in the return air, as determined by the Burrell gas-detector, varied from 0.8 per cent. in the North split to 1.9 per cent. in the West split.

Conditions generally have been good all over the mine, roadways maintained in a good state of repair, and a good supply of timber kept in places convenient for the use of the workmen, while the "systematic timbering" order has been fairly well attended to at the working-faces. The mine has been kept fairly free from dust by the use of the spraying systems, and all main roads are treated with a combination of second-burnt ashes and water.

No. 3 Mine.

J. Biggs, Overman; R. Phillips, W. Brown, and E. Caufield, Firebosses.

This mine operates the eastern portion of the No. 2 seam. It is ventilated by 16- by 8-foot Wilson fan, running at a speed of 142 revolutions a minute, which produces an average quantity of 51,100 cubic feet of air a minute, under a water-gauge of 3.5 inches.

At the last inspection the ventilation was good and measured as follows: South split, 380 by 64: 24,320 cubic feet of air a minute for the use of thirty-three men and three horses; B.G.D., 1.7 per cent. methane. Incline split, 320 by 55: 17,600 cubic feet of air a minute for the use of twenty-two men and four horses; B.G.D., 0.8 per cent. methane. Main return, 890 by 60: 53,400 cubic feet of air a minute for the use of fifty-five men and seven horses.

No explosive gas has been found in this mine during the year in the course of inspection, and the percentage of methane in the return air, as determined by the Burrell gas-detector, varied from 0.7 per cent. in the Incline split to 1.8 per cent. in the South split.

A good supply of timber has been on hand at all times for the use of the workmen and the requirements of the "systematic timbering" order very well attended to at the working-faces. Roads have been maintained in good shape and the mine kept fairly free of coal-dust by the spraying systems, the main roads being treated regularly with second-burnt ashes. We have generally found conditions to be very good in this mine throughout the year.

No. 2 Mine.

C. McNay, Overman; J. Bushell, E. Ward, and W. Clarkstone, Firebosses.

This mine is on the south side of the valley and mines the south and west portion of No. 2 seam. It is ventilated by a 16- by 8-foot Wilson fan, which, running at a speed of 132 revolutions a minute, produces an average quantity of 38,750 cubic feet of air a minute, under a water-gauge of 3 inches.

The quantities passing in the various splits at the last inspection measured as follows:—Rock tunnel, 240 by 90: 21,600 cubic feet of air a minute for the use of fifty-seven men and six horses; B.G.D., 1 per cent. methane. High-line, 1,740 by 2: 3,480 cubic feet of air a minute for the use of eight men and two horses. Main return, 460 by 85: 34,850 cubic feet of air a minute for the use of sixty-five men and eight horses.

Explosive gas has been found once during the year in the course of inspection; on this occasion above the timbers at the face of the High-line level; while the percentage of methane present in the return air in the Rock Tunnel split, as determined by the Burrell gas-detector, has varied from 0.5 to 1 per cent.

Conditions generally have been good during the year; spraying systems have been maintained; these, with regular applications of second-burnt ashes on the main roads, have kept the mine fairly free from coal-dust.

We have generally found a good supply of timber kept in places convenient for the use of the workmen, while the "systematic timbering" order has been fairly well attended to at the working-faces. Roadways have been maintained in good shape and the work of repairing the main return airway still continues.

No. 1 South Mine.

F. Landers, Overman; W. Hynds, W. Stockwell, W. Morgan, and M. Hilton, Firebosses.

This mine is situated half a mile to the west of the tipple and mines the western portion of the No. 1 seam, the workings all being to the rise of the main haulage-road. It is ventilated by an electrically driven 8- by 4-foot Keith fan, running at a speed of 260 revolutions a minute, which produces an average quantity of 25,940 cubic feet of air a minute, under a water-gauge of 2.5 inches.

At the last inspection the quantity passing in the main return measured as follows: 260 by 100: 26,000 cubic feet of air a minute for the use of sixty-eight men and fourteen horses; B.G.D., 1.2 per cent. methane.

In the course of inspection explosive gas has been found eighteen times during the year, while the methane content present in the return air, as determined by the Burrell gas-detector, has varied from 1 to 1.6 per cent. Roadways have been maintained in fairly good shape, a good supply of timber has generally been provided for the use of the workmen, and the "systematic timbering" order fairly well attended to at the working-faces. Considering the amount of repair-work that is continually being done, general conditions have been fairly good during the year.

No. 1 North Mine.

J. Worthington, Overman: E. Rutledge, J. Charnock, and H. Parsons, Firebosses.

This mine operates the western portion of the No. 1 seam on the north side: having a fairly good roof, and being close to the outcrop, no trouble has been experienced with gas to any great extent, and we have generally found conditions very good.

This mine is all on one split and is ventilated by an electrically driven 7- by 4-foot Keith fan, running at a speed of 210 revolutions a minute, which produces an average quantity of 21,000 cubic feet of air a minute, under a water-gauge of 1.8 inches.

The ventilation was good at the last inspection and measured as follows: Main return, 430 by 50: 21,500 cubic feet of air a minute for the use of sixty-men and nine horses. No explosive gas was found during the year in the course of inspection, roadways and working-faces have been kept in good condition, a good supply of timber generally provided for the use of the workmen, and the "systematic timbering" order well attended to at the working-faces.

The methane content in the return air has always been under 0.5 per cent., and the mine kept fairly free from dust. A considerable amount of cleaning-up and repairing has been done in the No. 9 district, with a view to making a connection with the inclines now driving up from the No. 9 mine.

No. 9 Mine.

Robert Fowler, Fireboss.

This mine is on the north side of the valley and mines the No. 2 seam. During the year the principal work has been driving the main and counter levels and repairing the return airway. It is ventilated by a Wilson fan, which, running at a speed of 50 revolutions a minute, produces an average quantity of 9,500 cubic feet of air a minute, under a water-gauge of 2.3 inches.

At the last inspection the quantity passing in the main return measured as follows: 169 by 50, 8,000 cubic feet of air a minute for the use of sixteen men and three horses.

A good supply of timber has been provided for the use of the workmen and the requirements of the "systematic timbering" order fairly well attended to at the working-faces. Roadways and working-faces are in good shape and the mine is fairly free of coal-dust, second-burnt ashes being spread regularly on the main roads.

No. B North Mine.

W. Commons, Overman: Jas. Whyte and E. Jones, Firebosses.

This mine operates the B seam and is situated east of the tipple at an elevation of 200 feet above it. It is ventilated by an electrically driven 10- by 3-foot Brazil fan, which, running at a speed of 150 revolutions a minute, produces an average quantity of 42,560 cubic feet of air a minute, under a water-gauge of 1.5 inches.

Explosive gas has been found three times during the year in the course of inspection, while the methane content in the return air, as determined by the Burrell gas-detector, has varied from 1.2 to 1.8 per cent. in the No. 2 split.

Conditions have been fairly good throughout the year, roadways kept in good shape, a good supply of timber always provided for the use of the workmen, and the "systematic timbering" order fairly well attended to at the working-faces. Spraying systems have been maintained and the mine kept fairly free of coal-dust.

The ventilation was good at the last inspection and measured as follows:—No. 2 split, 240 by 70: 16,800 cubic feet of air a minute for the use of thirty-five men and three horses; B.G.D., 1.5 per cent. methane. No. 1 split, 230 by 65: 13,950 cubic feet of air a minute for the use of twenty-five men and three horses. Main return, 750 by 65: 48,750 cubic feet of air a minute for the use of sixty men and six horses.

The following are the official returns from the Coal Creek Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	49,535			
" export to United States	320,410			
" " other countries				
Total sales		369,945		
Used in making coke				
Used under colliery boilers, etc.	36,621			
Total for colliery use		36,621		
Stocks on hand first of year	120			
" last of year	7,077			
Difference added to stock during year		6,957		
Output of colliery for year		413,523		

Number of Hands employed, Daily Wages paid, etc.*

Character of Labour.	Underground.		Above Ground		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	27		10		37	
Whites—Miners	378				378	
Miners' helpers						
Labourers	103		69		172	
Mechanics and skilled labour	186		120		306	
Boys	8		8		16	
Japanese						
Chinese						
Indians						
Totals	702		207		909	

* Does not include Fernie coke-ovens; not operated since April 4th, 1919.

The following shows the number of days Coal Creek Colliery worked each month during 1921:—

January	15	August	21
February	16	September	18
March	19	October	17
April	16	November	22
May	14	December	17
June	15		
July	17	Total	207

No. 1 mine worked only 10 days in December.

Name of seams or pits—No. 1 North, No. 1 South, and No. 1 East, same seam; No. B, Nos. 2, 3, and 9, same seam.

MICHEL COLLIERY.

Robert Bonar, Manager; Archibald Howden, Assistant Manager.

This colliery is situated on both sides of Michel creek, 24 miles north of Fernie, and has connection with both the Canadian Pacific and Great Northern Railways. Three mines have been operated during the year—Nos. 3 and 3 East on the south side of Michel creek, mining the upper No. 3 seam, while the No. 8 mine on the north side is operating the seam of the same name.

The general method of work is pillar and stall, rooms being turned off from the levels every 60 feet; crosscuts between rooms set off at the same distance, leaving pillars measuring 60 by 60 feet. The work of extracting pillars is being carried out to some extent in Nos. 8 and 3 East mines.

No. 8 mine being situated at an elevation of 500 feet above the tipple, the coal from this mine is weighed at the tipple at the top of the incline; then dumped into storage, from which it is loaded into skips and lowered by gravity to loading-chutes at the foot of the incline, from which it is drawn into the mine-cars and hauled to the tipple by endless-rope haulage.

The main tipple is of steel construction throughout, is 640 feet in length, and receives coal on both sides; the loaded cars from the South side being weighed at the foot of the tipple incline, up which they are taken by an endless chain-haul which travels on car wheels, the latter acting as pushers or retarders on the incline; these move in behind the rear wheels of the car, thereby conveying it up to the dump on the tipple.

This dump is simply a continuation of the track, with a pitch increasing from 20° to 60°; as the car reaches this point the door is opened and the coal discharged into the dump, the chain-haul continuing to travel around a large sprocket-wheel conveying the empty to the overhead track and back down the incline.

On the No. 8 side an automatic dump is in use, the cars being returned by a transfer underneath the track to the endless-rope haulage, which delivers them back at the foot of the incline. The tipple is equipped with shaking screens and picking-tables for separating the slack from the lump coal, the former being conveyed to storage-bins, from which it is drawn as required for the purpose of making coke, and provision is made for loading both open and box cars, two Smith gravity box-car loaders being used for loading the latter. No additions were made to the boiler plant and surface equipment during the year, a description of which was given in the 1920 Report of the Minister of Mines.

The safety-lamp in general use is the Edison electric mine-safety cap-lamp, while the Wolf is used by the bratticemen and officials for testing purposes, Burrell gas-detectors being provided to determine lower percentages of methane in the air-current than can ordinarily be detected by the Wolf safety-lamp.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at the colliery.

Following is a brief description of the mines and the conditions prevailing therein:—

No. 3 Mine.

M. Littler, Overman; A. Frew, A. Davis, T. Owen, and T. James, Firebosses.

This mine is working the upper No. 3 seam, this being reached by a crosscut tunnel from the surface which intersects Nos. 5, 4, 3, and 3 East seams, the latter seam only being mined. It is ventilated by a 12- by 6-foot Sullivan fan, running at a speed of 130 revolutions a minute, which produces an average quantity of 65,670 cubic feet of air a minute, under a water-gauge of 2.2 inches.

At the last inspection the ventilation was good and measured as follows:—Main return, 1,100 by 100: 110,000 cubic feet of air a minute for the use of eighty-four men and eight horses. West side, 180 by 175: 31,500 cubic feet of air a minute for the use of forty-four men and four horses. East side, 580 by 90: 52,200 cubic feet of air a minute for the use of forty men and four horses.

Explosive gas has been found four times in the course of inspection, the quantities being small in each case and found close to the roof at the face. The percentage of methane in the return air, as determined by the Burrell gas-detector, has varied from 0.3 per cent. in the West side to 1.6 per cent. in the East side.

General conditions have been fairly good, roadways maintained in good shape, a good supply of timber being generally provided for the use of the workmen, and the "systematic timbering" order fairly well attended to at the working-faces.

Spraying systems are in operation on all roads that are inclined to be dry and dusty, and the mine has been maintained fairly free from dust at all inspections.

No. 3 East Mine.

M. D. McLean, Overman; A. Ball, W. Picton, R. Clarkstone, and R. McFegan, Firebosses.

This mine is also mining the upper No. 3 seam and is situated about half a mile east of the tipple. It is ventilated by a 16- by 8-foot Wilson fan, which, running at a speed of 124 revolutions a minute, produces an average quantity of 107,480 cubic feet of air a minute, under a water-gauge of 2.3 inches.

During the year explosive gas has been found ten times in the course of inspection, generally in cavities in the roof, while the methane content in the return air, as determined by the Burrell gas-detector, has varied from 1 per cent. in the No. 6 East split to 1.8 per cent. in the West split.

Working-faces and roadways have been kept in good shape, with the exception of the No. 6 East return airway, which is in need of repairs in several places. We have generally found a good supply of timber on hand for the use of the workmen and the "systematic timbering" order well attended to at the working-faces. The mine has been kept fairly free from dust by the use of water-spraying systems, second-burnt ashes being spread frequently on the main roads.

At the last inspection the ventilation was good and the quantities passing in the various splits measured as follows:—Main return, 1,760 by 63: 110,880 cubic feet of air a minute for the use of eighty-eight men and ten horses. West split, 1,060 by 50: 53,000 cubic feet of air a minute for the use of forty-eight men and five horses; B.G.D. (not acting). No. 6 East, 250 by 96: 24,000 cubic feet of air a minute for the use of forty men and five horses; B.G.D., 1.1 per cent. methane. East of slope: 520 by 40: 20,800 cubic feet of air a minute for the use of ten men. No. 6 East slant, 180 by 28: 5,040 cubic feet of air a minute; this district has been stopped for some time.

No. 8 Mine.

Thos. Baybutt, Overman; A. Almond, E. Ainsworth, J. Marsh, and R. Taylor, Firebosses.

This mine is situated at an elevation of 500 feet above the tipple on the north side of the valley and mines the No. 8 seam. It is ventilated by a compressed-air-driven 8- by 4-foot Murphy fan, running at a speed of 150 revolutions a minute, which produces an average quantity of 34,960 cubic feet of air a minute, under a water-gauge of 0.5 inch.

The quantities passing in the various splits at the last inspection measured as follows:—West side, 600 by 30: 18,000 cubic feet of air a minute for the use of fifty-two men and six horses. No. 6 incline, 450 by 40: 18,000 cubic feet of air a minute for the use of fifty-six men and six horses. Main return, 600 by 70: 42,000 cubic feet of air a minute for the use of 108 men and twelve horses.

We have not found any explosive gas during the year in the course of inspection, and the percentage of methane in the return air has been kept under one-half of 1 per cent. Roadways and working-faces have been maintained in good shape, a good supply of timber generally provided for the use of the workmen, and the "systematic timbering" order fairly well attended to at the working-faces. While the mine has been kept fairly free of dust, some method of dealing with this should be considered for the No. 6 Incline district, where some of the roadways are inclined to be dry.

The grade has been completed for a new gravity-plane to be operated from one of the upper levels which has been driven through to the surface.

The following are the official returns of the Michel Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	35,932	.....	41,878	.....
" export to United States	133,889	.....	18,092	.....
" " other countries	.....	.....	.....	.....
Total sales	.....	169,821	.....	59,970
Used in making coke	85,644	.....	.....	.....
Used under colliery boilers, etc.	19,383	.....	.....	.....
Total for colliery use	.....	105,027	.....	.....
Stocks on hand first of year	.....	.....	580	.....
" last of year	3,453	.....	44	.....
Difference { *added to / †taken from } stock during year	.....	*3,453	.....	†536
Output of colliery for year	.....	278,301	.....	59,434

Number of Hands employed, Daily Wages paid, etc. (including Coke-ovens).

Character of Labour.	Underground.		Above Ground.		Totals.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	17	.....	13	.....	30	.....
Whites—Miners	249	.....	.....	.....	249	.....
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	30	.....	181	.....	211	.....
Mechanics and skilled labour	115	.....	96	.....	211	.....
Boys	4	.....	9	.....	13	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	6	.....	6	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	415	.....	305	.....	720	.....

The following shows the number of days Michel Colliery worked each month during 1921:—

January	20½	August	20
February	20	September	18
March	23	October	16
April	18	November	22
May	14	December	21
June	14		
July	16	Total	222½

No. 3 side worked only 10 days during December.

Name of seams or pits—New No. 3 (top section of No. 3 seam); Old No. 3 (lower section of No. 3 seam); New No. 8 (Old No. 8 seam continued).

Corbin Coal and Coke Co., Ltd.

Head Office—Spokane, Wash.

Capital, $7,000,000.

Officers.	*Address.*
Rush Taggert, President.	New York, N.Y.
J. K. O. Sherwood, Vice-President.	New York, N.Y.
Wm. Weaver Heaton, Secretary-Treasurer.	New York, N.Y.
A. M. Allen, Assistant Treasurer,	Spokane, Wash.
R. S. Ord, General Manager,	Spokane, Wash.
E. L. Warburton, Mine Manager,	Corbin, B.C.

Value of plant, $400,000.

CORBIN COLLIERY.

E. L. Warburton, Manager.

This colliery is situated 14 miles from McGillivray Junction on the Crowsnest branch of the Canadian Pacific Railway, is reached by means of the British Columbia Eastern Railway, and consists of the following mines: Nos. 4, 5, and 6. No coal has been produced during the year from the No. 3 mine or "Open-cut"; the latter has been dismantled and the equipment brought down to the central yards at the colliery.

The boiler plant, consisting of two Jencks return-tubular boilers and one of the locomotive type, has a total capacity of 275 horse-power. The electric plant consists of one 70-horse-power generator, alternating type, 2,300 volts, driven by one 100-horse-power steam-engine, and provides the power to drive the motors at the machine-shops, the fan at No. 6 mine, and for lighting purposes around the town of Corbin.

The tipple, constructed of wood, has a bunker capacity of 1,200 tons and is equipped with a Marcus screen and conveyor-belt, driven by a 60-horse-power steam-engine. A lamp-room is located in a central position at the mines, where all safety-lamps are cleaned and repaired.

The lamps in use are chiefly the Edison electric type, the remainder being the Wolf-safety, the latter being used by the officials for testing purposes, while a Burrell gas-detector is provided for the detection of lower percentages of methane in the mine-air than can ordinarily be detected by the Wolf safety-lamp.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at the colliery.

Following is a brief descrpition of the mines and the conditions prevailing therein throughout the year:—

Nos. 4, 5, and 6 Mines.

W. Almond, Overman; H. Osborne, Shiftboss; J. Virgo, G. Luck, G. Elmes, H. Ferryman, and E. Hardie, Firebosses.

The No. 4 mine is operating the No. 4 seam, which is vertical and varies from 50 to 200 feet in thickness. During the year the most of the coal has been taken from the 400 and 500 levels,

where the method of extracting the pillars is by the caving system on the retreat, and a fairly large area in these levels can now be mined by this method.

The only development-work done during the year was in the 300 Right level, but a considerable amount of repair-work has been done cleaning up old roadways in preparation for extracting the pillars, and at present a new road is driving through the old workings to provide better haulage facilities in the 300 level. No further trouble has been experienced with fires during the year and careful watch is maintained at the sealed-off area in No. 4 level.

At the last inspection the ventilation was good and measured as follows: Intake airway, 720 by 35: 25,200 cubic feet of air a minute for the use of twenty-eight men and two horses.

No explosive gas was found by us during the year, roadways and timbering in good shape, plenty of timber being provided for the use of the workmen, and the "systematic timbering" order well attended to at the working-faces.

This mine, being naturally damp, is free from coal-dust and conditions generally have been very good throughout the year.

No. 5 Mine.

Very little work has been done during the year. The main and counter levels have now been driven a total distance of 500 feet from the point of entry, but work was suspended in November.

No. 6 Mine.

A considerable amount of work has been done at this mine during the year, a tipple being completed, to which the coal is lowered by chutes from the various levels; a tramway has also been constructed from the railway to the upper workings, by which the material is conveyed to the mine.

An outlet has been put through to the surface from the 5,315 level, and a small Sirocco fan, estimated to deliver 10,000 cubic feet of air a minute, is now being installed at this place.

No gas has been found in this mine and conditions have been very good at all inspections; a good supply of timber being provided at all times for the use of the workmen and the "systematic timbering" order well attended to at the working-faces.

Crosscutting has proved this seam to be about 400 feet thick, and it is being blocked out double-stall method, pillars between levels measuring 70 by 120 feet.

The following are the official returns from the Corbin Colliery for the year ending December 31st, 1921:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	18,794			
" export to United States	41,032			
" " other countries				
Total sales		59,826		
Used in making coke				
Used under colliery boilers, etc.	4,656			
Total for colliery use		4,656		
Stocks on hand first of year	5,765			
" last of year	9,214			
Difference added to stock during year		3,449		
Output of colliery for year		67,931		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	7	8.81	9	6.08	16	7.44
Whites—Miners	45	7.84	.....	.....	45	7.84
Miners' helpers	38	6.89	.....	.....	38	6.89
Labourers	.....	.....	35	6.80	35	6.80
Mechanics and skilled labour	.....	.....	10	7.70	10	7.70
Boys	.....	.....	1	4.40	1	4.40
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	90	.....	55	.....	145	.....

Name of seams or pits—No. 3 mine or "Big Showing," open-work; Nos. 4, 5, and 6 mines, underground.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 3 mine: During the year no stripping or coal operations have been attempted at this mine, same being idle all year. Shay locomotives, shovels, air dump-cars, contractor's outfit, etc., have been moved down to Corbin. No. 4 mine: During the year bulk of coal from this mine has been won from pillar-work on 400 and 500 levels by the caving-retreating system. A comparatively large area of this ground in both levels is now available for retreating; 300 Right workings have been advanced 500 feet, the coal at this point being about 150 feet between containing walls. It is not being operated just now owing to poor business conditions, which also applies to A tunnel. No. 5 mine: Level and counter have been advanced to a point 500 feet from entry, the coal being about 18 feet wide between walls. It also has been abandoned until business conditions improve. Coal at face of this level when stopped showed analysis of 0.75 moisture; 22.75 V.C.; fixed carbon, 69; ash, 7.50 per cent. No. 6 mine: At the elevation 5,315 section the rock tunnel struck coal at 150 feet, where a 12-foot seam of hard coal was found and a level driven north on same for 60 feet; the main tunnel advanced about 25 feet in shales from this point, where coal was again struck; tunnel is now advanced 200 feet in coal. A level to the south has been driven 275 feet and levels now being put off to the north. It is expected the width of seam at this point will be at least 400 feet, and running north about 2 miles with depth unknown. At the elevation 5,390 a road was driven across the seam in coal for 375 feet, the containing walls being well defined. Work to the north has been advanced 500 feet, the bed of coal being blocked out double-stall method and pillars of 210 by 250 feet, pillars between levels and counters being 70 by 120 feet. At the elevation 5,456 section roadway is now being driven across the seam and has advanced 150 feet, when hanging-wall has been reached. It is proposed to block out this upper section for retreating, which will be worked on the "top-slicing method" to prevent surface material from mixing with coal. This mine can now quickly be producing 500 tons a day if necessary.

Description and length of tramway, plant, etc.—Nos. 3 and 4 mines as per previous report. No. 5 mine: Tipple shedding has been completed. No. 6 mine: Small boiler and hoist to handle timbers to different levels. Timber tramway from railway to top level, 700 feet, laid with 40-lb. steel. Wash-house temporary; three sprays and hand-basins, with change and drying room to take care of fifty men; boiler erected, 600 feet 2-inch line to water-supply, radiators, etc. Small Sirocco fan for development purposes, capacity 10,000 cubic feet a minute, against a 4-inch water-gauge. Loading-chutes from elevation 5,240 to 5,456 to lower coal to railway-track, to be replaced later by retarding conveyor. Tipple and shedding to handle run of mine from loading-chutes to railway-cars. At the main tipple, Corbin, Marcus screen and apron-conveyor have been adjusted to more adequately handle rock and clean coal.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Date.	Name.	Mine.	Occupation.	Offence charged.	Judgment.
Jan. 18....	Casiso Angelo.....	No. 1, Granby	Miner	For having pipe in his possession in violation of General Rule 91	Fined $5.
Jan. 18....	B. Martinella.....	No. 4. Cumberland	Miner	For refusing to sprag coal.....	Fined $10.
Feby. 1....	John Liddle.....	No. 4, No. 1 slope, Cumberland	Fireboss.....	For not guarding place when blasting	Fined $10.
Feby. 7....	Adam Watson....	No. 5. Wellington Extension	Fireboss.....	For infraction of Special Rule 44	Fined $10 and costs.
April 30....	F. A. Gibbons	No. 3, Extension	Driver.....	For allowing a miner to ill-treat his mule	Fined $10.
April 30....	George Copp	No. 3, Extension	Miner	For ill-treating a mule.....	Fined $25 and costs.
June 7....	John Donnachie ..	No. 1, Granby (Cassidy's)	Fireboss.....	For infringement of Rule 12, C.M.R. Act	Fined $10 and costs.
June 14....	Telephore Janard.	Extension	Labourer.....	For forging a coal miner's certificate of competency	Fined $50.
Oct. 3....	J. Tabacak	No. 2, Coal Creek.	Miner	Failing to sprag undermined coal, contrary to Special Rule 115	Fined $5 and costs.
Oct. 5....	J. Bisoni	No. 1. East, Coal Creek	Miner	Failing to use sprag for undermined coal, contrary to Special Rule 115	Fined $5 and costs.
Oct. 5....	T. Chubra.....	No. 1, East, Coal Creek	Miner	Failing to use sprags for undermined coal, contrary to Special Rule 115	Fined $5 and costs.
Oct. 18....	Harry McGuire...	No. 1, North, Coal Creek	Miner	For having matches in his possession	Fined $5 and costs.
Nov. 21....	Jew Yoy	No. 4, Comox.....	Chinese labourer	For infringement of Rule 9, C.M.R. Act	Fined $10.
Nov. 21....	Andrew J. Alber..	Granby (Cassidy's)	Miner	For infringement of Rule 9, C.M.R. Act	Fined $5.
Nov. 24....	R. Miza.....	No. 5, Comox	Miner	Having matches and cigarette-papers	Fined $10 and costs.
Nov. 25....	John Farrow	No. 3, East, Michel	Miner	For riding on trip contrary to Special Rule 63	Fined $10 and costs or 30 days.
Nov. 25....	M. Rubos	No. 3, Michel.....	Miner	Failing to sprag undermined coal, contrary to Special Rule 115	Fined $10 and costs or 30 days.
Nov. 25....	T. Tonkin	No. 3, Michel.....	Miner	Failing to sprag undermined coal, contrary to Special Rule 115	Fined $10 and costs or 30 days.
Dec. 5...	John Jonas, Jr....	No. 1, Granby	Rope-rider	Having matches in his possession in violation of General Rule 9.....	Fined $10 and costs.

METALLIFEROUS MINES SHIPPING IN 1921.

CASSIAR.

ATLIN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Maid of Erin	Rainy Hollow	R. W. Wiley	Atlin	Gold, silver, copper.

SKEENA.

SKEENA MINING DIVISION.

Belmont-Surf Inlet	Surf inlet	Belmont-Surf Inlet Mines, Ltd.	Surf Inlet	Gold, silver, copper.
Drum Lummon	Douglas channel	Drum Lummon Mines, Ltd	Vancouver	Gold, silver, copper.

NASS RIVER MINING DIVISION.

Dolly Varden	Alice arm	Taylor Engineering Co., Ltd.	Vancouver	Silver.
Golskeish	Anyox	H. W. Heidman	Anyox	Gold, silver.
Hidden Creek	Anyox	Granby Cons. M. S. & P. Co.	Anyox	Gold, silver, copper.

PORTLAND CANAL MINING DIVISION.

Premier	Salmon river	Premier Gold Mining Co	Stewart	Gold, silver.

OMINECA MINING DIVISION.

Corderilla	Kitsalas mountain	Kitsalas Mt. Copper Co., Ltd.	Usk	Gold, silver, copper.
Silver Standard	Hazelton	W. G. Norrie-Lowenthal	New Hazelton	Gold, silver, lead, zinc.

EAST KOOTENAY.

FORT STEELE MINING DIVISION.

North Star	Kimberley	Thompson & McKinney	Kimberley	Silver, lead.
Sullivan	Kimberley	Consolidated M. & S. Co.	Kimberley	Silver, lead, zinc, iron
Victor	Fort Steele	E. Abernethy	Spokane	Gold, silver, lead. [pyrites.

WINDERMERE MINING DIVISION.

Paradise	Toby creek	R. R. Bruce	Invermere	Silver, lead.

WEST KOOTENAY.

AINSWORTH MINING DIVISION.

Bluebell	Riondel	S. S. Fowler	Riondel	Silver, lead.
Florence	Ainsworth	F. R. Wolfle	Spokane	Silver, lead.
Grant	Ainsworth	Bridge & Kennedy	Ainsworth	Gold, silver, lead.
Highland	Ainsworth	Consolidated M. & S. Co.	Trail	Silver, lead.
Jessie Bluebird	Woodbury creek	Eric Johnson	Kaslo	Gold, silver, lead.
Krao	Ainsworth	W. E. Zwicky	Kaslo	Silver, lead.
Little Mamie	Ainsworth	MacLeod G. & S. Mining Co.	Ainsworth	Gold, silver, lead.
Mohawk	Adamant	J. H. Chisholm	Kaslo	Gold, silver, lead.
Ruth	Ainsworth	James Anderson	Kaslo	Silver.
Spokane-Trinket	Ainsworth	Jas. McDougall	Ainsworth	Silver, lead.
Skyline	Ainsworth	H. Giegerich	Kaslo	Silver, lead.
Utica	Paddy peak	T. R. French	Kaslo	Silver, lead.
Violet	Woodbury creek	J. Henry	Ainsworth	Silver, lead.
Whitewater	Retallack	W. H. Burgess	Kaslo	Gold, silver, lead, zinc.
Silver Bell	South fork, Kaslo creek	S. H. Green	Kaslo	Silver, lead.

SLOCAN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Alamo	Alamo	C. Cunningham	Sandon	Silver, lead.
Bosun	New Denver	Rosebery-Surprise Mining Co.	New Denver	Silver, lead, zinc.
Canadian and Adams	Sandon	" "	"	Silver, lead.
Chambers group	Slocan	H. G. Clarke	Sandon	Silver, lead.
Freddie Lee	Sandon	J. H. Tatterie	Sandon	Silver, lead.
Idaho	Sandon	C. Cunningham	Sandon	Silver, lead.
Ivanhoe	Sandon	Rosebery-Surprise Mining Co.	New Denver	Silver, lead.
Last Chance	Sandon	Robt. Cunning	Sandon	Silver, lead.
Mollie Hughes	New Denver	H. Clever	New Denver	Gold, silver, lead.
Queen Bess	Sandon	C. Cunningham	Sandon	Silver, lead.
Rambler	Three Forks	W. A. Cameron	Three Forks	Silver, lead, zinc.
Redress	Sandon	H. T. Twigg	Enderby	Silver, lead.
Richmond	Sandon	C. Cunningham	Sandon	Silver, lead.
Silversmith	Sandon	John B. White	Sandon	Silver, lead, zinc.
Sovereign	Sandon	C. Cunningham	Sandon	Silver, lead.
Standard	Silverton	W. H. North	Silverton	Lead, zinc.
Surprise	Sandon	J. P. McFadden	Sandon	Gold, silver, lead.
Majestic	Sandon	Gus Fandrey	Sandon	Gold, silver, lead, zinc.
Van-Roi	Silverton	C. Cunningham	Sandon	Silver, lead.
Wonderful	Sandon	C. Cunningham	Sandon	Silver, lead.
Gem	Carpenter creek	M. J. Byrne.	Sandon	Silver, lead.

SLOCAN CITY MINING DIVISION.

L. T.	Springer creek	D. B. O'Neail	Slocan	Silver.
Black Prince	Springer creek	C. E. Cartwright	Vancouver	Silver, lead.
Ottawa	Slocan	L. H. Biggar	Slocan	Silver.

NELSON AND ARROW LAKE MINING DIVISION.

Champion	Park Siding	S. N. Ross	Fruitvale	Gold, silver.
Gold Hill	49 creek	Geo. Gormley	Nelson	Gold, silver, copper.
Millie Mack	Burton (Arrow Lake)	H. E. Forster	Wilmer	Gold, silver, lead.
Nugget	Sheep creek	Harold Lakes	Salmo	Gold.

TRAIL CREEK MINING DIVISION.

Centre Star	Rossland	F. S. Peters	Rossland	Gold, silver, copper.
I.X.L.	Rossland	R. B. Shelledy	Rossland	Gold, silver, copper.
Le Roi No. 2	Rossland	D. Lay	Rossland	Gold, silver, copper.
Velvet	Rossland	J. W. Gregory	Rossland	Gold, silver, copper.

REVELSTOKE, TROUT LAKE, AND LARDEAU MINING DIVISIONS.

Ferguson Mines	Trout lake	James Anderson	Kaslo	Gold, silver, lead.

BOUNDARY.

GREENWOOD MINING DIVISION.

Castor Frac	Beaverdell	J. Sutherland	Greenwood	Silver.
Kokomo	Beaverdell	J. M. Barrett	Beaverdell	Gold.
Providence	Greenwood	Wm. Madden	Greenwood	Gold, silver, lead.
Sally	Beaverdell	E. A. Morley	Penticton	Silver, lead.
Wellington	Wallace mountain	J. Sutherland	Beaverdell	Silver, lead.

GRAND FORKS MINING DIVISION.

Emma	Ebolt	Consolidated M. & S. Co.	Trail	Gold, silver, copper.
Rock Candy	Grand Forks	Consolidated M. & S. Co.	Trail	Fluorspar.

OSOYOOS MINING DIVISION.

Horn Silver	Similkameen	E. W. Condit	Similkameen	Gold, silver.

LILLOOET AND CLINTON MINING DIVISIONS.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Pioneer	Cadwallader creek	C. L. Copp	Lorne Mine	Gold.

SOUTH COAST.

VANCOUVER MINING DIVISION.

Britannia	Howe sound	W. S. Browning	Britannia Beach	Gold, silver, copper.

NANAIMO MINING DIVISION.

Good Hope	Texada island	H. Wolburn	Vananda	Iron.
Marjorie	Texada island	J. McConville	Texada island	Gold.
Venus	Lasqueti island	A. N. Skill	Vancouver	Gold, silver, copper.

LIST OF CROWN GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1921.

CASSIAR.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Buttercup	Atlin	Maurice Egerton	3282	15.96	Oct. 31
Calder	"	Horace McNaughton Fraser	1276	39.35	July 30
Daffodil	"	Maurice Egerton	1279	49.98	Oct. 31
Daisy	"	Horace McNaughton Fraser	1278	24.69	July 30
Merry	"	"	1275	23.96	July 30
Pansy	"	Robert Webster	1280	37.14	Oct. 31
Primrose	"	Horace McNaughton Fraser	1277	43.34	July 30
Rose	"	"	3281	14.44	July 30
Big Lode	Nass River	Charles Munroe and Abbotsford Lumber, Mining & Development Co., Ltd.	4215	4.69	April 25
Blueberry	"	Ditto	4217	39.92	April 25
Copper Cliff No. 2	"	Arne Davidson	3808	38.05	Dec. 20
Copper Cliff No. 3	"	Joseph Wells	3798	40.26	Dec. 21
Copper Cliff No. 3	"	George Alexander Young, Joseph Well, and Arne Davidson	3806	45.74	Mar. 4
Copper Cliff No. 1	"	George Alexander Young, Joseph Well, and Arne Davidson	3807	42.40	Mar. 4
Copper Crest	"	Bernard Livingstone Johnson	3346	51.57	Mar. 15
Dan Patch	"	Richard B. Linzey *et al.*	3825	43.69	Sept. 10
Gray Copper	"	Charles Munroe and Abbotsford Lumber, Mining & Development Co., Ltd.	4214	43.57	April 25
Iron Cap	"	Ditto	4216	51.65	April 25
Lue Dillon	"	Richard B. Linzey *et al*	3827	26.21	Sept. 10
Maude S	"	"	3828	29.38	Sept. 10
Nancy Hanks	"	"	3826	44.15	Sept. 10
Nome Fraction	"	Hans Pedersen	3519	21.58	Mar. 16
North Star Fraction	"	Edward Lewin	4211	16.88	July 11
Ruby	"	"	4210	27.94	July 12
Yellow Cedar	"	Charles Munroe and Abbotsford Lumber, Mining & Development Co., Ltd.	4213	43.66	April 25
Alta	Omineca	Hinterland Resources, Limited	9081	8.46	Aug. 20
Bison	"	Archibald T. Harrer	6315 R. 5	34.97	Nov. 24
Calgary Fraction	"	Robert J. Miller	9088	16.56	Oct. 27
Edmonton	"	Hinterland Resources, Limited	9082	46.61	Sept. 7
High Level	"	"	9084	28.43	Aug. 20
Homestake	"	The Cats Mining Co., Ltd. (N.P.L.)	3309	42.07	July 12
Lake View	"	Louis Schorn	6284 R. 5	51.26	June 9
Last Chance	"	Hinterland Resources, Limited	9080	13.66	Aug. 20
Low Level	"	"	9083	20.28	Aug. 20
Mammoth	"	The Cats Mining Co., Ltd. (N.P.L.)	3307	23.21	July 12
North Star	"	Robert J. Miller	9090	51.65	Oct. 26
Peace River	"	"	9079	49.33	Oct. 26
Selwyn	"	"	9078	46.52	Oct. 26
Tiger	"	The Cats Mining Co., Ltd. (N.P.L.)	3308	36.24	July 12
Una	"	Robert J. Miller	9089	36.50	Oct. 26
Argentite	Portland Canal	Silver Crest Mines, Ltd. (N.P.L.)	4153	49.35	June 8
Ax Fraction	"	Bush Mines, Ltd. (N.P.L.)	3852	6.55	Feb. 3
Bell	"	"	3842	40.47	June 9
Bell No. 2	"	"	3849	40.24	Feb. 3
Bush Fraction	"	B.C. Silver Mines, Ltd.	4147	33.11	June 10
Cascade Forks No. 1	"	William Bunting	3603	46.90	April 25
Cascade Forks No. 6	"	"	3608	38.70	April 25
Cascade Forks No. 2	"	Charles Bunting	3604	28.15	April 25
Cascade Forks No. 3	"	"	3605	31.50	April 25
Cascade Forks No. 4	"	"	3606	20.00	April 25
Cascade Forks No. 5	"	"	3607	30.30	April 25
Cerargerite	"	Silver Crest Mines, Ltd. (N.P.L.)	4160	43.63	June 8
Climax	"	Bush Mines, Ltd. (N.P.L.)	3841	50.97	Feb. 3
Dixie	"	B.C. Silver Mines, Ltd. (N.P.L.)	4135	8.81	Mar. 10
Forks	"	David O'Leary	3610	38.80	April 25
Good Hope	"	Albert B. Armstrong and William Reid Tooth	4037	29.57	Dec. 6
Grandview	"	B.C. Silver Mines, Ltd. (N.P.L.)	4142	29.07	June 10
Gun Fraction	"	Bush Mines, Ltd. (N.P.L.)	4016	20.45	Feb. 3
Halton	"	B.C. Silver Mines, Ltd. (N.P.L.)	4146	33.31	June 10
Hessite	"	Silver Crest Mines, Ltd. (N.P.L.)	4159	51.65	June 8
Hooligan	"	David O'Leary	4019	51.52	Mar. 7
Humboldt Fraction	"	B.C. Silver Mines, Ltd. (N.P.L.)	4137	32.66	Mar. 7
Humboldt No. 2 Fraction	"	"	4136	17.96	Mar. 7
Lesley	"	Bush Mines, Ltd. (N.P.L.)	3839	51.65	June 9
Lesley No. 2	"	" "	3843	50.57	Feb. 3
Lesley No. 3	"	" "	3845	41.22	Feb. 3
Lesley No. 4	"	" "	3844	28.49	June 9
Lesley No. 5	"	" "	3846	39.20	Feb. 3
Lesley No. 6	"	" "	3847	51.44	June 9
Lesley Fraction	"	" "	3848	31.49	June 9
Lesley M.	"	" "	3838	51.65	Feb. 3
Limit	"	" "	3840	51.65	June 9
Mahood	"	" "	3850	31.91	June 9
Millan Dollar Fraction	"	Forty-nine Mining Co., Ltd. (N.P.L.)	4034	17.67	Feb. 15

CASSIAR—*Continued.*

Claim.	Division.	Grantee.	Lot.	Acre.	Date.
Mountain	Portland Canal	B.C. Silver Mines, Ltd. (N.P.L.)	4141	51.65	June 10
Native	"	Silver Crest Mines, Ltd. (N.P.L.)	4158	45.59	June 8
Neill Fraction	"	B.C. Silver Mines, Ltd. (N.P.L.)	4148	35.74	June 10
Oakville Fraction	"	Charles Henry Lake	4021	11.89	Mar. 7
Oakville No. 2 Fraction	"	"	4022	19.92	Mar. 7
Oakwood	"	"	4020	7.34	Mar. 7
Occidental Fraction	"	Forty-nine Mining Co., Ltd. (N.P.L.)	4035	2.53	May 18
Polybacite	"	Silver Crest Mines, Ltd. (N.P.L.)	4154	51.65	June 8
Proustite	"	" "	4156	22.48	June 8
Pyrargyrite	"	" "	4155	44.77	June 8
Rincon	"	B.C. Silver Mines, Ltd. (N.P.L.)	4143	26.40	June 10
September Fraction	"	Silver Crest Mines, Ltd. (N.P.L.)	4163	38.50	June 8
Silver Crest Fraction	"	" "	4162	29.79	June 8
Simcoe	"	B.C. Silver Mines, Ltd. (N.P.L.)	4145	24.58	June 10
Stephanite	"	Silver Crest Mines, Ltd. (N.P.L.)	4157	51.65	June 8
Stromeyrite	"	" "	4161	43.30	June 8
Ten Fraction	"	Bush Mines, Ltd. (N.P.L.)	3851	40.62	June 9
Texada	"	B.C. Silver Mines, Ltd. (N.P.L.)	4133	22.30	Mar. 7
U & I	"	" "	4144	50.27	June 10
Wood Fraction	"	Premier Gold Mining Co., Ltd.	3609	5.60	April 25
Eagle	Skeena	Joseph Dawson	6513	42.54	Sept. 7
Keith Fraction	"	James Falkner	2236 R. 4	25.06	Jan. 14

EAST KOOTENAY.

Arras Fraction	Fort Steele	The Consolidated Mining & Smelting Co. of Canada, Ltd.	6725	50.40	May 4
Betty Fraction	"	" "	12526	0.17	April 25
Byng	"	" "	7348	51.39	April 1
Cram	"	" "	5931	49.54	April 1
Creek	"	" "	12936	51.65	Dec. 9
Daughter	"	" "	12943	51.65	Dec. 9
Douglass	"	" "	7325	51.65	April 2
Eileen Fraction	"	" "	9386	43.27	Mar. 30
Elkhorn	"	" "	2991	48.60	Feb. 7
Enough Fraction	"	" "	12928	42.06	Mar. 30
Foch	"	" "	7345	51.14	Mar. 31
Hagia	"	" "	12938	51.65	Dec. 9
Haig	"	" "	7349	51.55	April 5
Hiram	"	" "	12944	49.33	Dec. 9
Hoogie	"	" "	6715	45.45	April 5
Hored	"	" "	12933	51.07	Dec. 9
Irene Fraction	"	" "	9387	35.10	Mar. 30
Jessie Fraction	"	" "	6727	46.37	April 1
Joshua	"	" "	12941	51.65	Dec. 9
J. Y. A	"	" "	12925	46.45	Mar. 30
Lake Fraction	"	" "	7342	45.41	Mar. 31
Lille	"	" "	5933	51.04	April 5
Locre	"	" "	5934	51.48	April 5
Major	"	" "	12942	51.65	Dec. 9
Menin Fraction	"	" "	6724	50.02	April 1
Midas	"	" "	5456	44.04	Feb. 7
Miller	"	" "	7343	51.65	April 31
Mosquito Fraction	"	" "	12926	44.66	Mar. 30
Mildred	"	" "	7344	51.65	April 31
Mt. Mariah	"	" "	12930	49.19	Dec. 15
Norman	"	" "	7347	51.37	April 1
Pedro	"	Norman William Burdett	2313	51.65	Mar. 2
Pershing Fraction	"	The Consolidated Mining & Smelting Co. of Canada, Ltd.	9875	17.06	Nov. 29
Petain	"	" "	7346	51.65	April 1
Plummer Fraction	"	" "	9876	29.71	April 30
Red Devil	"	" "	7341	51.65	Mar. 30
Rex	"	" "	12935	35.31	Dec. 9
Roaring Bill	"	" "	7328	51.65	April 2
Robert C. Fraction	"	" "	3710	0.46	April 25
Rossland	"	" "	12927	46.35	Mar. 30
Roulers Fraction	"	" "	6717	39.29	April 25
Ruby Fraction	"	" "	12934	31.93	Dec. 9
Sarnia	"	" "	12937	51.65	Dec. 9
Seaton Fraction	"	" "	12527	17.40	Mar. 30
Sirus	"	" "	12931	50.79	Dec. 9
Sojourner	"	" "	12939	51.65	Dec. 9
Solomon	"	" "	12940	51.65	Dec. 9
Summit	"	" "	12929	51.65	Mar. 30
Thor	"	" "	12932	44.43	Dec. 9
Vimy	"	" "	6716	51.65	April 5
Watau Fraction	"	" "	6723	23.00	April 25
Ypres	"	" "	5932	48.24	April 1
Silver Moon	Windermere	Burton S. Fox	11708	51.65	July 8
Excelsior	Golden	Keith Campbell Macgirvan	1107	51.65	Nov. 3
Favorite	"	James J. McConnell	1116	49.90	Nov. 14
Timbasket	"	Matthew Henry Robertson Moodie	1975	37.30	Mar. 17
Whistler Fraction	"	John J. McCabe	1117	10.85	Nov. 14

WEST KOOTENAY.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Ada Fraction	Ainsworth	Philip Thomas Corrigan	10064	33.80	Jan. 31
Albatross Fraction	"	"	10063	36.40	Jan. 31
Morning Star No. 2	"	"	4885	48.89	Mar. 8
White Elephant	"	George C. Read	3159	43.18	Mar. 22
Winona Fraction	"	Philip Thomas Corrigan	10061	44.10	Jan. 31
Benson Fraction	Nelson	Agnes Billings and Percy Ferdinand Horton	12671	7.65	Sept. 3
Canyon	"	" "	12670	47.60	Aug. 18
Carbonate Hill	"	Agnes Billings	12677	47.28	Sept. 3
Easter	"	Percy Ferdinand Horton and Agnes Billings	12668	41.63	Aug. 18
Golden	"	P. F. Horton and Sidney N. Ross	12676	51.65	Aug. 18
Good Hope	"	William Joseph Williams	4382	33.88	Oct. 28
No. 1 Fraction, Good Hope Fraction	"	"	4383	15.90	Oct. 28
Homestead Fraction	"	Percy Ferdinand Horton	12678	7.05	Aug. 18
H. B.	"	Percy Ferdinand Horton and John Adolph Benson	12672	42.08	Sept. 3
Leadville	"	" "	12673	28.05	Sept. 3
Lilly B. Fraction	"	Percy Ferdinand Horton	12669	32.02	Sept. 3
Mother Lode Fraction	"	Agnes Billings	12674	0.79	Sept. 3
Republic	"	George Thomas Gormley	3208	25.20	Dec. 15
Ross Fraction	"	John Adolph Benson	12675	45.03	Sept. 3
Stanley	"	Edward Francis Phillips	4384	16.72	Oct. 27
Dayton	Slocan	Matthew Peace Reid	2419	41.53	Jan. 8
Accidental	Slocan City	Robert G. McLeod	4258	31.81	Mar. 10
F. L. C.	"	Grace McLeod	4262	16.36	Mar. 10
Get there Eli	"	"	4261	12.63	Mar. 10
Reno	"	Robert G. McLeod	4259	30.84	Mar. 10
V. & M.	"	James David Weghtman	4260	20.93	April 5
Agnes B. Fraction	Trail Creek	Frederick Samuel Lee	1704	27.77	Feb. 8
Almaden	"	John Lindsay Maclachlan	2678	15.48	Oct. 20
Belcher	"	Edward Nugent	1951	33.24	Dec. 16
Bluebell	"	Rossland Velvet Mines, Ltd. (N.P.L.)	5206	50.48	May 26
Charlston	"	Robert E. Crerar	975	12.62	Feb. 2
Douglas	"	John S. Godfrey	2865	39.23	Oct. 20
Florence	"	Alan Bruce Ritchie	1354	51.21	Oct. 20
Freeburn	"	William Munroe Archibald	957	25.90	Oct. 20
G. B. Architect Fraction	"	Frederick Samuel Peters	1707	27.54	Feb. 8
Golden Rule	"	Oswald Bisson and Martin Dalby	12278	51.59	Jan. 31
Golden Terra	"	Lawrence William Oughtred	1338	5.78	Oct. 20
Good Hope	"	Melbourne McKim O'Brien	4005	49.27	Mar. 8
Grey Eagle	"	Rowland Bell Shelledy	3713	45.05	Feb. 8
Jumbo No. 3	"	Rupert Malcolm Macaulay	3218	2.81	Oct. 26
Jumbo No. 3 Fraction	"	" "	3030	2.40	Oct. 20
La Belle	"	Melbourne McKim O'Brien	729	9.96	Mar. 8
Latest out	"	William James Garbutt	959	32.00	Oct. 20
Maple Leaf	"	Ella Stoddart	12867	29.03	Nov. 29
Mary D.	"	William James Garbutt	1514	38.82	Oct. 20
Mispickel	"	William Munroe Archibald	1761	34.27	Oct. 20
Palo Alto	"	John Lindsay Maclachlan	950	51.44	Oct. 20
Poor Property	"	Selwyn Gwillym Blaylock	1273	50.45	Oct. 25
Rainy Day	"	Robert E. Crerar	1339	45.75	Feb. 21
Tramway	"	Alan Bruce Ritchie	1826	22.71	Oct. 20
Venus	"	Selwyn Gwillym Blaylock	1213	30.35	Oct. 25
Violet	"	Rowland Bell Shelledy	3714	50.98	Feb. 8
Vulcan Fraction	"	James Buchanan	3397	16.93	Nov. 17
Canmore	Lardeau	Emma Theresia Blockberger	5677	34.10	Oct. 13
Big Hope Fraction	Revelstoke	Shadwick Lewis Williams	8250	19.06	July 13

BOUNDARY.

Arlington	Grand Forks	Henry P. Jackson	2596	44.65	Feb. 21
Hastings	"	Fred Rutherford and Charles Schwartzenhauer	2053	51.65	Aug. 15
Hesperus Fraction	"	Johnson Wilmont Clark	3057	27.64	Sept. 1
May	"	Joseph J. Bassett	2217 S.	47.75	July 30
Ah There	Greenwood	Colin McRae	1960	17.75	Mar. 8
Big Ledge	"	Paul Nelson	826	51.65	July 5
Bonnie Belle	"	Ola Lofstad	880	51.18	Jan. 7
Buckhorn	"	James Napier Paton	1107	51.65	Feb. 8
C. S. & H.	"	Andrew Jackson	833	40.41	July 5
Crescent No. 2	"	Agnes Forshaw	1257	41.02	May 31
Crown Point	"	James Kerr	2448	34.71	Dec. 9
Deadwood	"	Colin McRae	1962	48.86	Mar. 8
Electric	"	Leo Ernest Brawders	1575	30.02	Jan. 7
Ethiopia	"	Jennie Duhamel	932	42.38	Jan. 7
Maple Leaf Fraction	"	George Alfred Bryan	2040	34.91	Mar. 2
O. B.	"	Ola Lofstad	828	48.03	Oct. 13
Roderick Dhu	"	Lewis Bryant	598	51.65	Jan. 7
S. F. Fraction	"	Frederick Johnson	832	40.35	Aug. 15
Shoo Fly	"	James Grant	1547	46.75	June 14
Spokane	"	Robert Lee	1011	31.22	May 19
Sunset	"	John Allan Fraser	2068	49.76	Mar. 9
Syd. M. Johnson	"	Thomas Branagan	1961	49.29	Mar. 16
Tintic	"	"	1461	14.37	Feb. 8
Victoria	"	James Kerr	218	20.60	April 12
Warwick Fraction	"	Elizabeth Frances Lee	616 S.	46.25	Feb. 7
White Rock	Kamloops	William Wallace Elder	4023	44.71	Jan. 27

BOUNDARY—*Continued.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
C. P. Fraction	Lillooet	Index Molybdenite Mining Co., Ltd. (N.P.L.)	1309	29.62	Nov. 22
Globe	"	" "	1307	51.65	Nov. 22
Index	"	" "	1306	51.65	Nov. 22
Last Chance	"	" "	1310	50.07	Nov. 22
Legal Tender	"	" "	5074	51.65	Nov. 22
Lucky Jack Fraction	"	" "	5076	33.39	Dec. 13
Sunset	"	Peter Ferguson	3045	47.19	Nov. 16
Titanic Fraction	"	Andrew Ferguson	3053	9.15	Nov. 16
August 12	Similkameen	Canada Copper Corporation, Ltd. (N.P.L.)	2298 S.	51.65	Sept. 8
August 13	"	" "	2299 S.	26.00	Sept. 8
August 14	"	" "	2300 S.	19.60	Sept. 8
Benard	"	" "	2007 S.	47.70	Jan. 19
Copper Cent No. 1	"	" "	2304 S.	9.60	Sept. 8
First Chance No. 1	"	" "	2302 S.	35.20	Oct. 3
Good Cheer	"	" "	2002 S.	47.60	Jan. 19
Irish Mag	"	" "	2010 S.	38.20	Jan. 19
Last Chance No. 1	"	" "	2303 S.	46.70	Sept. 8
Lemon No. 2	"	" "	2006 S.	51.40	Sept. 8
Lemon No. 5	"	" "	374 S.	48.80	Sept. 8
Lemon No. 7	"	" "	2008 S.	42.90	Sept. 8
Lemon No. 9	"	" "	2011 S.	44.70	Sept. 8
Lemon No. 11	"	" "	2003 S.	44.90	Sept. 8
Margaret No. 1 Fraction	"	" "	2310 S.	9.50	Sept. 8
Moore No. 1	"	" "	2301 S.	37.50	Sept. 8
Tessie	"	" "	2009 S.	42.60	Jan. 19
Upsilon	"	" "	2013 S.	4.40	Jan. 19
Zapata Fraction	"	" "	2572 S.	23.50	Sept. 8
Silver Bell	Vernon	Amelia Bell	4329	51.65	Mar. 30
Anita	Clinton	Ephraim Coulter Davison	3266	34.60	Dec. 13
Margaret	"	"	3267	26.50	Dec. 2
I. I. C. Fraction	Nicola	Samuel Ryder	4208	33.32	Jan. 31
Lucky Jim	"	"	4209	49.09	Jan. 31
Sunrise Fraction	"	"	3256	42.98	Jan. 31

VANCOUVER ISLAND AND COAST.

Blue Bell	Nanaimo	Andrew Dixon	258 R. 1	51.20	Dec. 13
Empress	"	Alexander Smith	279	44.90	Aug. 16
Ex Ray	"	Harvey W. Wells	61	39.20	May 6
Ex Ray No. 2	"	"	62	43.79	May 6
Ex Ray No. 3	"	"	63	33.61	May 6
Humming Bird	"	David George Kennedy	4815 A.	49.04	Feb. 16
May Flower	"	"	4816 A.	51.65	Feb. 10
Nigger Baby No. 1	"	Harvey W. Wells	64	38.02	May 9
Portage	"	Andrew Dixon	259 R. 1	51.65	Dec. 13
Double Standard	Clayoquot	William Wilson	1249	49.99	Jan. 26
Eight	"	John David McLeod	1647	51.65	July 13
Ex	"	"	1644	48.04	July 13
Ivenhoe	"	William Wilson	1250	38.28	Jan. 26
Sechart	"	Ellen Oliver Mansfield	Sect. 3	20.66	Oct. 18
Ten	"	John David McLeod	1645	47.86	July 13
You	"	"	1646	49.73	July 12
By Joe Fraction	Quatsino	Ole Anderson Sherberg	1552	0.81	Oct. 4
Dasher Fraction	"	Albert Frederick Arnold and Andrew Anlle Gibbens	1549	10.43	Dec. 8
Independent	"	Maud Mary Arnold and Harry George Adams	1550	51.65	Dec. 8
Independent No. 1	"	Albert Frederick Arnold and Mary Smith Gibbens	1551	28.92	Dec. 8
Owl	"	Edward Leo Sullivan	1585	38.61	July 4
Snowbird No. 1	"	"	1587	42.72	July 4
Snowbird No. 2	"	Louise Evenson	1588	50.80	July 4
Snowbird No. 3	"	Andrew Baker	1586	46.23	July 4
Summit Fraction	"	William James Vaughan, Albert Frederick Arnold, John Kussman, and Ole Anderson Sherberg	1554	10.00	Dec. 13
Giant	Vancouver	Quincy Dunn Chapman	3400 G. 1	38.37	Jan. 24
Hercules	"	"	4879 G. 1	49.09	Jan. 24
Limit Fraction	Alberni	Walter Cecil Keeling, Albert Frederick Arnold, Kathrine de Fehr and Harry George Adams	1553	13.35	Nov. 16
Adaline	Victoria	Gabbro Copper Mines, Ltd. (N.P.L.)	829	51.65	Jan. 11
Ada Fraction	"	Sunloch Mines, Ltd. (N.P.L.)	844	36.39	Mar. 18
Black Hornet	"	Gabbro Copper Mines, Ltd. (N.P.L.)	828	44.62	Jan. 11
Cliff Fraction	"	" "	835	1.69	July 14
Gabbro	"	" "	825	38.18	Jan. 11
Gabbro Fraction	"	" "	826	0.38	Jan. 11
Lucky Bunch	"	" "	833	31.46	Jan. 11
Mud Wasp	"	" "	832	35.12	Jan. 11
Queen Bee	"	" "	831	35.99	Jan. 11
Sombrio	"	Sunloch Mines, Ltd. (N.P.L.)	839	49.76	Mar. 18
Tiger	"	" "	838	19.30	Mar. 18
Vulcan No. 1	"	Gabbro Copper Mines, Ltd. (N.P.L.)	819	37.26	Jan. 11
Vulcan No. 2	"	" "	820	3.77	Jan. 11
Vulcan No. 3	"	" "	821	51.63	Jan. 12
Vulcan No. 4	"	" "	822	21.49	Jan. 12
Vulcan No. 5	"	" "	823	16.90	Jan. 13
Vulcan No. 6	"	" "	824	38.75	Jan. 13
Vulcan Fraction	"	" "	834	17.93	Jan. 13
War Eagle	"	" "	830	51.45	Jan. 14
Yellow Jacket	"	" "	827	41.91	Jan. 14

DEPARTMENT OF MINES.

VICTORIA, B.C.

Hon. Wm. Sloan, *Minister of Mines.*

R. F. Tolmie, *Deputy Minister.*

Wm. Fleet Robertson, *Provincial Mineralogist and Assayer.*

Jas. McGregor, *Chief Inspector of Mines.*

Henry Devlin, *District Inspector*, Nanaimo.

T. R. Jackson, *District Inspector*, Nanaimo.

Robert Strachan, *District Inspector*, Fernie.

John Macdonald, *District Inspector*, Fernie.

John G. Biggs, *District Inspector*, Merritt.

Thos. J. Shenton, *District Inspector*, Prince Rupert.

H. H. Johnstone, *Temporary Inspector*, Nelson.

A. G. Langley, *Resident Engineer*, Revelstoke.

D. E. Whittaker, *Provincial Analyst and Assistant Assayer.*

J. D. Galloway, *Resident Engineer*, Hazelton.

W. M. Brewer, *Resident Engineer*, Nanaimo.

Geo. A. Clothier, *Resident Engineer*, Prince Rupert.

P. B. Freeland, *Resident Engineer*, Grand Forks.

Resident Engineer, Kamloops.

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin Mining Division	Atlin	J. A. Fraser	W. G. Paxton	
Sub-office	Telegraph Creek			H. W. Dodd.
"	Haines (U.S.)		(Com. for taking Affidavits)	Risdon M. Odell.
Stikine Mining Division	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary	"	"	John Wynne.
Liard Mining Division	Telegraph Creek	"	"	
Sub-office	Porter			Chas. H. Smith.
"	McDame Creek			Mike Larsen.
"	Fort St. John			F. W. Beatton.
Skeena Mining Division	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Alice Arm			Telka Carney.
"	Kitimat			G. L. Anderson.
"	Swanson Bay			S. C. White.
"	Copper City			L. G. Skinner.
"	Terrace			L. H. Kenny.
"	Stewart (Portland Canal)			J. P. Scarlett (Acting).
Nass River	Anyox	J. H. McMullin	J. Conway (Acting).	
Portland Canal M.D.	Stewart	J. H. McMullin (at Prince Rupert)	J. P. Scarlett "	
Bella Coola Mining Div.	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Bella Coola			Brynild Brynildsen.
"	Bella Bella			John A. Pauline.
"	Ocean Falls			A. M. Tyson.
Queen Charlotte Min'g D.	Queen Charlotte	J. H. McMullin	John L. Barge	
Sub-office	Jedway			Isaac Thompson.
"	Masset			R. P. Ponder.
"	Lockeport			William Morgan.
Omineca Mining Division	Smithers	Stephen H. Hoskins	Jas. E. Kirby	
Sub-office	Fort Grahame			T. A. Kerry.
"	Fort St. James			Alex. C. Murray.
"	Manson Creek			W. B. Steele.
"	Telkwa			T. J. Thorp.
"	Fort St. John			F. W. Beatton.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca M.D.—*Con.*				
Sub-office	Copper City			L. G. Skinner.
"	Terrace			L. H. Kenny.
"	Fort Fraser			Fred Fraser.
"	Junction Finlay &	Parsnip rivers.		A. T. Sherwood.
"	Pacific			T. H. McCubbin.
"	Hazelton			Sperry Cline.
"	Burns Lake			L. Mulvaney.
"	Houston			W. J. Lutley.
"	Usk			Jas. L. Bethurum.
Peace River Mining Div.	Fort St. John	S. H. Hoskins	F. W. Beatton	
Sub-office	Hudson Hope	(at Hazelton)		F. F. Monteith.
"	Pouce Coupe			J. D. Moore.
Cariboo Mining Division.	Barkerville	L. A. Dodd		
Sub-office	Quesnel	"		E. C. Lunn.
"	Fort George	"		T. W. Herne.
"	McBride	"		M. Gorman.
Quesnel Mining Division.	150-Mile House	L. A. Dodd	R. M. McGusty	R. M. McGusty.
Sub-office	Quesnel	(at Barkerville)		E. C. Lunn.
"	Quesnel Forks			Wm. Lowden.
"	Barkerville			L. A. Dodd.
Clinton Mining Division.	Clinton	Geo. Milburn		
Lillooet Mining Division.	Lillooet	John Dunlop	John Dunlop	
Kamloops Mining Division	Kamloops	E. Fisher	L. S. Brown	L. J. Price.
Sub-office	Chu Chua			George Fennell.
"	Vavenby			Hyde Finley.
"	Albas			C. O. Sjouquist.
Ashcroft Mining Division.	Ashcroft	E. Fisher (at Kam.)	J. S. Alexander	
Sub-office	Lytton			Thos. Somerville.
Nicola Mining Division	Merritt	E. Fisher (at Kam.)	J. A. Murchison	
Yale Mining Division	Yale	" "	H. Beech	
Sub-office	Hope	" "		Wm. Greenwood.
Similkameen Mining Div.	Princeton	Hugh Hunter	Hugh Hunter	
Sub-office	Hedley			Jas. Clarke.
Vernon Mining Division.	Vernon	L. Norris	M. S. Morrell	
Greenwood Mining Div.	Greenwood	W. R. Dewdney	W. R. Dewdney	
Sub-office	Vernon			M. S. Morrell.
"	Rock Creek			Owen Wheeler.
"	Beaverdell			E. F. Ketchum.
Grand Forks Min. Div.	Grand Forks	S. R. Almond	S. R. Almond	
Osoyoos Mining Division.	Oliver	J. R. Brown		
Sub-office	Olalla			R. W. Northey.
"	Hedley			Jas. Clarke.
Golden Mining Division.	Golden	John Bulman	H. C. Moore	
Windermere Mining Div.	Wilmer	" (at Golden)	E. M. Sandilands	
Fort Steele Mining Div.	Cranbrook	N. S. A. Wallinger.		
Sub-office	Steele			Joseph Walsh.
"	Fernie			R. J. Stenson.
"	Moyie			W. H. Laird.
"				
Ainsworth Mining Div	Kaslo	Ronald Hewat.	A. McQueen	A. W. Anderson.

Gold Commissioners and Mining Recorders—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Ainsworth M.D.—*Con.*				
Sub-office	Howser			W. Simpson.
"	Trout Lake			Oscar Jacobson.
"	Crawford Bay			Thos. W. Lytle.
"	Poplar			Arthur G. Johnston.
Slocan Mining Division	New Denver	Ronald Hewat	Angus McInnes	
Sub-office	Sandon	(at Kaslo)		W. J. Parham.
Slocan City Mining Div.	Slocan	Ronald Hewat	Thos. McNeish	
Trout Lake Mining Div.	Trout Lake	"	Oscar Jacobson	
Nelson Mining Division	Nelson	J. Cartmel	J. Cartmel	
Sub-office	Creston			R. Lamont.
"	Ymir			Wm. Dowling.
"	Sheep Creek			Geo. Leece.
"	Salmo			M. C. Donaldson.
Arrow Lake Min. Division	Nakusp	J. Cartmel	Walter Scott	
Sub-office	Vernon	(at Nelson)		M. S. Morrell.
Revelstoke Mining Div.	Revelstoke	A. Johnson	J. Lee	Newton R. Brown.
Lardeau Mining Division	Beaton	" (at Revelstoke)	Ernest Roberts	
Trail Creek Mining Div.	Rossland	H. R. Townsend		
Nanaimo Mining Division	Nanaimo	S. McB. Smith	S. McB. Smith	
Sub-office	Ladysmith			John Stewart.
"	Alert Bay			Ernest H. Robinson
"	Vananda			Leonard Raper.
"	Quathiaski Cove			S. Marshall.
"	Granite Bay			Henry Twidle.
"	Campbell River			T. W. Hanson.
Alberni Mining Division	Alberni	A. G. Freeze	A. G. Freeze	
Clayoquot Mining Division	Clayoquot	" (at Alberni)	W. T. Dawley	
Quatsino Mining Division	Quatsino	" "	Ed. Evensen	
Victoria Mining Division	Victoria	Herbert Stanton	Herbert Stanton	
New Westminster Min. D.	New Westminster	F. C. Campbell	I. Wintemute	
Sub-office	Harrison Lake			L. A. Agassiz.
"	Chilliwack			J. Pelly.
Vancouver Mining Div.	Vancouver	John Mahony	A. P. Grant	

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VICTORIA, B.C.
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1922.

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British Columbia. *Bureau of Mines.*

Annual Report of the Minister of Mines for the year ending 31st December, 1921, being an account of mining operations for gold, coal, etc., in the Province. William Fleet Robertson, Provincial Mineralogist. 365 pp., plates, maps, 1921.
Victoria, Government Printing Office, 1922.

Author.

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